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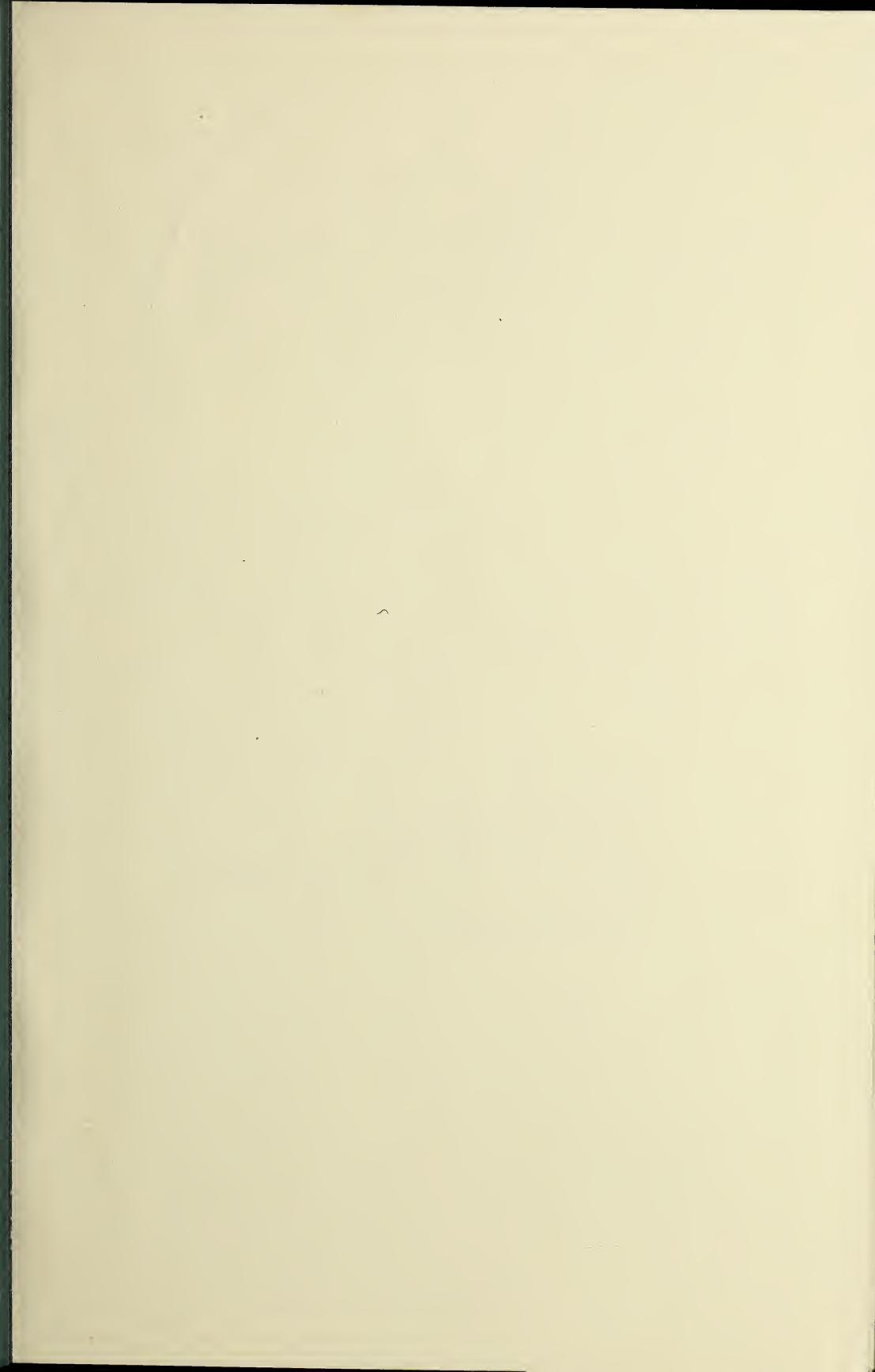
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A Test and Evaluation of the Modigliani
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and Miller Propositions

*Assistant Professor of Finance
University of Southern California*

ALEXANDER BARGES

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P R E N T I C E - H A L L , I N C .

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Foreword

Dr. Barges' dissertation, one of five selected for publication in the fourth annual Doctoral Dissertation Competition sponsored by the Program in Economic Development and Administration of The Ford Foundation, was completed during the academic year 1961-62.

The dissertation competition, which is open to doctoral candidates in business administration, the social sciences, and other fields relevant to the study of problems of business, is intended to recognize and encourage excellence in research on business by graduate students. In this year's competition the selection committee chose five such dissertations, to be added to the fifteen outstanding ones that have already been published. Publication awards are made to persons granted doctorates in business and related fields whose thesis research is especially distinguished by its analytical content and strong roots in the underlying disciplines common to business.

The dissertations selected this year in addition to Dr. Barges' include the following:

Simulation of Information and Decision Systems in the Firm

Charles P. Bonini

Graduate School of Industrial Administration

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Department of Economics

University of Chicago

Statistical Decision and Related Techniques in Oil and Gas Exploration

Gordon M. Kaufman

Graduate School of Business Administration

Harvard University

Mathematical Programming and Analysis of Capital Budgeting Problems

H. Martin Weingartner

Graduate School of Industrial Administration

Carnegie Institute of Technology

On behalf of The Ford Foundation, I wish to express my gratitude to the members of the Editorial Committee for the care and thought they devoted to the selection process. The members of this Committee, who made the final selection of winning dissertations, are: Professor Alex Bavelas of Stanford University, Professor Roy Blough of Columbia University, and Professor Robert Ferber of the University of Illinois.

The Editorial Committee's task was considerably lightened by the assistance of ten readers, experts in the wide range of disciplines covered in the competition, who carefully screened the theses submitted. The Foundation joins the Committee in acknowledging their debt to Professors Thomas L. Whisler and Harry V. Roberts of the University of Chicago, Paul E. Breer of Cornell University, Lyman W. Porter and Earl F. Cheit of the University of California (Berkeley), Robert B. Fetter of Yale University, Daniel M. Holland of the Massachusetts Institute of Technology, Bernard Karsh of the University of Illinois, Donald P. Jacobs of Northwestern University, and Joseph W. Newman of Stanford University.

Finally, my colleagues and I wish to acknowledge the important contribution of Prentice-Hall, Inc. to the publication of the selected dissertations.

CLARENCE H. FAUST
VICE PRESIDENT
THE FORD FOUNDATION

New York, N. Y.
January, 1963

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ALEXANDER BARGES



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**THE EFFECT
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CHAPTER 1

Introduction

This paper deals with the question of the effect of capital structure on the cost of capital to the firm. The concept of capital cost occupies a central place in the theory of the management and allocation of corporate capital, and in recent years it has received considerable attention from both theorists and practitioners. Yet in spite of the work which has been devoted to it, one important question which still remains unresolved is the question of how the cost of capital to the firm is affected by capital structure.¹ To put this question in its proper perspective and to show its relation to the problems of capital budgeting it will be necessary to discuss briefly the meaning of the cost of capital.

The term "cost of capital" is used in many different ways, and with each different usage of the term there is implied a different decision criterion for the allocation of a firm's capital. In the past the term was frequently used in connection with the costs of specific forms of capital, such as the cost of debt funds and the cost of equity funds. When used in this sense the term carried the implication that the profitability of a proposed capital project could be evaluated on two different cost bases. Thus, if the expected rate of return of a proposed project exceeded the cost of equity funds, as measured by the expected rate of earnings or dividend yield, the project was attractive and could be financed by either equity or debt funds, since the rate of return exceeded the cost of capital in either case. On the other hand,

¹ Cf., Ezra Solomon, *The Management of Corporate Capital* (Illinois: The Free Press of Glencoe, 1959), p. 16.

if the expected rate of return of the project were below the cost of equity funds, the financing of the project by stock sale would reduce the stockholder per-share earnings; in this case the project should be considered only if the rate of return on the project exceeded the cost of debt funds. (In recent years, however, it has become increasingly recognized that one cannot speak of the costs of specific types of capital in isolation.) It is now generally recognized that the real costs of specific types of capital are frequently different from their apparent costs. To see this one need only realize that while the interest costs of debt are much lower than expected, (equity costs, the use of debt creates risks to the shareholders, and such risks are in turn reflected in higher equity costs.) In other words, the cost of equity funds is influenced to some extent by the debt ratio of the firm, and any higher equity costs which result from debt financing should be regarded as part of the cost of debt funds.

Because of the dependence of both debt and equity costs on debt ratios, it is now customary to speak of the "cost of capital" as some form of weighted average of the debt and equity costs. This average cost shows the minimum rate of return which a proposed project should earn in order to be accepted. If the expected rate of return of a project is less than the average cost, then the project should be rejected, for acceptance would be disadvantageous to the shareholders.

While the average cost of capital is a useful concept of capital cost, there are a number of problems associated with it which still remain unsettled. First of all, there is the important question of how the cost of equity should be measured for purposes of computing the weighted average. Professional opinion differs markedly on this question, and two schools of thought can be distinguished. Both schools agree that the cost of common stock capital is the expected rate of return required by investors, but the difference of opinion lies in whether this return should be measured in terms of dividends or in terms of earnings. The first school holds that dividends are the ultimate source of value for a stock and that the cost of equity capital should therefore be measured by an expected dividend-price ratio.¹ The other school—perhaps the more popular—holds that the expected future

¹ The foundation for this approach is J. B. Williams, *The Theory of Investment Value* (Cambridge: Harvard University Press, 1938). The use of the expected dividend-price ratio in the calculation of average cost has recently been recommended by Bierman and Smidt, *The Capital Budgeting Decision* (New York: The Macmillan Company, 1960).

earnings are the source of value of a stock and that the cost of equity should be measured by an expected earnings-price ratio.¹ This school holds that if the management of a firm behaves rationally the earnings which are not paid out will enhance the future earnings of the company and thereby enhance the value of the stock. If investors behave rationally, in turn, they should be indifferent as to whether their return from a share comes in the form of dividends or in the form of capital appreciation.

A second problem connected with the average cost of capital is that this concept of cost, when used as a criterion for accept-reject decisions of the firm, does not explicitly allow for the fact that different degrees of uncertainty attach to the future cash flows of different investment projects. Thus, a firm may be considering a project whose expected rate of return exceeds the estimated average cost of capital of the firm, but because of the uncertainty of the return there may be a good basis for rejecting the project. Conversely, another project may have an expected rate of return which is lower than the average cost of capital but which may be attractive because of the relative certainty of the return. When differential uncertainty exists between the returns of projects, the average cost criterion is not wholly adequate, and selection of projects must be made on some subjective basis. In discussing accept-reject decisions for projects which present different risks Joel Dean states:²

When no modifications for uncertainty are incorporated in the earnings estimate, they may be taken into account in appraising investments—informally, or by differential standards of acceptable rate of return.

While Dean states that differential standards may be used, he does not indicate any objective basis for setting such standards.

Because of the existence of differential uncertainty it has been suggested that a distinction be made between the "borrowing rate" of the firm and the "lending rate," and that the cost of capital be defined

¹ Among the many writers who hold that equity costs should be measured by earnings-price ratios are: Hunt and Williams, *Basic Business Finance* (Homewood, Ill.: Richard D. Irwin, 1958); Spencer and Siegelman, *Managerial Economics* (Homewood, Ill.: Richard D. Irwin, 1959); David Durand, "Costs of Debt and Equity Funds for Business: Trends and Problems of Measurement," *Conference on Research in Business Finance* (N. B. E. R., 1952).

² *Capital Budgeting* (Columbia University Press, 1951), p. 30.

as the "~~lending rate~~."¹ The borrowing rate of the firm is the rate which the firm must pay in order to raise external capital, and may be thought of as the average cost of capital. The lending rate, on the other hand, is the rate of return which the firm would earn if it committed its funds in investments outside the firms which have degrees of risk comparable to those of the proposed internal projects being considered. This lending rate concept of capital cost is an opportunity cost concept, and is one which gives explicit recognition to the fact that different degrees of risk attach to different future cash flows. According to this concept, the cost of capital for prospective projects will vary as the risks of the projects vary. The measure of capital cost which has been suggested is "the expected rate of return on equity investments outside the firm that appear to the entrepreneur to involve a degree of riskiness similar to those contemplated within the firm."² Because of difficulties of determining the "lending rate" for specific projects and because of administrative difficulties in applying it, the opportunity cost concept has not received much attention. However, the concept has much to commend it and warrants greater attention than it has received.³

The third question connected with the average cost concept—the question to which this paper is directed—is whether or not the average cost of capital to a firm can be reduced through the use of debt funds.

¹ The distinction between borrowing rate and lending rate was first made by Friedrich and Vera Lutz, *The Theory of Investment of the Firm* (Princeton, N. J.: Princeton University Press, 1951). The distinction was further developed in a later article by Harry V. Roberts; cf., "Current Problems in the Economics of Capital Budgeting," *Journal of Business* (January 1957).

² Harry V. Roberts, *ibid.*, p. 14.

³ Lending rates and borrowing rates are discussed in books which treat capital cost. See, for example, Bierman and Smidt, *The Capital Budgeting Decision*, and Erwin E. Nemmers, *Managerial Economics* (Evanston, Ill.: Northwestern University, 1962). As used by these writers, however, the term lending rate has a meaning which is different from the one given above. Thus, Nemmers states: "The lending rate is that which the business would receive if it were to invest its excess funds in the market." (Part VI, p. 40). Bierman and Smidt state: "... lending means acquiring a portfolio of securities issued by other firms and which have approximately the same average risk characteristics as the average of the other assets presently owned by the firm." (p. 163) Under these conceptions of lending rate, a firm would find it profitable to go to the market for funds if the lending rate exceeded the firm's borrowing rate. If the lending rate were below the borrowing rate there should be no borrowing (raising of capital) by the firm. In each case the "cost of capital" is the borrowing rate of the firm. This is in contrast to the opportunity cost concept of capital cost given above and discussed by Roberts, where the "cost of capital"—and the criterion for accept-reject decisions—varies with the project.

Put another way, this question is concerned with whether or not the real costs of debt are less than the costs of equity. It was indicated earlier that in the past there was a tendency among writers to regard debt funds as cheaper than equity funds. Implicit in this view is the assumption that the real costs of debt are less than the cost of equity funds and that, as a result, the weighted average of debt and equity costs declines as debt is utilized. Thus, when debt costs are taken as lower than equity costs, there is an implied assumption that the cutoff point for a firm's investment projects can be influenced by the use of debt funds. In recent years the validity of this view has been questioned by a number of prominent writers on the subject. Among these are Professors Franco Modigliani and Merton H. Miller, who, in a published paper devoted to the cost of capital and the theory of investment, advanced an alternative hypothesis of the effect of debt on the firm's cost of capital.¹

In their paper Professors Modigliani and Miller hold that the real costs of debt, after taking into account increases in equity costs, are the same as the costs of equity, and that the marginal cost of capital of the firm is equal to the average cost of capital. In other words, Modigliani and Miller advance the proposition that the average cost of capital to the firm is independent of the firm's capital structure. As a corollary, this proposition holds that the total market value of a firm is unaffected by the composition of securities in its capital structure.

The proposition that the cost of capital and the market value of a firm are independent of the firm's capital structure runs directly counter to the notions of finance specialists, who have traditionally held that debt funds are "cheap."² In spite of the importance of the question for practicing finance, however, the evidence which bears on the question is skimpy. In their paper Modigliani and Miller (hereafter M & M) present some preliminary evidence which tends to support their proposition, but the evidence which they present—which will be examined at a later point in this paper—is of questionable validity. Recently other empirical studies have appeared which bear

¹ "The Cost of Capital, Corporation Finance, and the Theory of Investment," *American Economic Review* (June 1958, 48:261-97).

² A third but less widely held notion which is also contrary to traditional views is that the total market value of a firm declines as debt is used. This has been suggested by A. M. Clifford, *The Evaluation of Corporate Securities*. Copyrighted and published by A. M. Clifford, Investment Counselor, Los Angeles, 1938, p. 57.

on the question, but these other studies have tended to run along the same lines of the M & M studies, and the results have been inconclusive.¹ The present study, therefore, was undertaken in an attempt to test the validity of the independence hypothesis by proceeding along somewhat different lines. In testing the validity of this hypothesis the M & M proposition has been selected as a focal point for investigation. This has been done, not because the independence hypothesis is unique to M & M, but because M & M have formulated the proposition in a way which lends itself to empirical investigation. In addition, M & M have backed their proposition with strong theoretical reasoning, and this is an area of interest in itself.

The approach followed in testing empirically the independence hypothesis is cross-section analysis, using three different industries with different characteristics at one point in time. The year selected for study is 1956—a recent year in which security markets were relatively stable. In conducting cross-section analyses with the industries selected, an attempt is made to determine whether or not the cost of equity funds increases significantly as debt is used, and whether or not the average cost of capital declines as debt is used. In this connection it should be noted that in directing the investigation toward these questions one other question which is important from an operational standpoint is bypassed. (This is the question of how debt affects the average cost of capital of a particular company.) In other words, what is the relation between average cost and debt for a particular company faced with an investment decision at a given moment in time? The purpose of capital budgeting is to assist *individual* firms in making rational investment and financial decisions, and a cross-sectional analysis utilizing data of a prior year may be of little value to a firm faced with a decision today, or a firm whose characteristics differ significantly from the average characteristics existing in a sample. While this is true, the question of the determination of the average cost relation for operational purposes for particular firms is bypassed, first, because it is a complex question in itself and, second, because it is preceded by the question of whether debt has any effect at all. If in

¹ Cf. Haskel Benishay, "Variability in Earnings-Price Ratios of Corporate Equities," *The American Economic Review* (March 1961), and J. Fred Weston, "The Cost of Capital: A Restatement of the Traditional Position," Unpublished Manuscript, U.C.L.A., 1961. Both Benishay and Weston measure risk the same way M & M do. Benishay states his findings are inconclusive. Weston achieves results similar to those presented by M & M, but he draws different conclusions.

fact average cost is independent of debt—as M & M hypothesize—there is no problem with the average cost relation for a particular company. Thus, a cross-sectional analysis of the kind conducted in the present study is a necessary first step in determining whether debt has any effect at all.

The plan of the paper is to first describe more fully the nature of the conflict between the M & M propositions and the views traditionally held by finance specialists. This is done in the present chapter. In Chapter 2 certain concepts necessary for an understanding of the empirical tests and the theory are discussed. Chapters 3, 4, and 5 discuss the empirical methods employed by M & M, the methods employed by the present investigator and the reasons for the differences, and the results of the research conducted along the different lines. In Chapter 6 the theoretical reasoning underlying the M & M propositions is presented and examined. Finally, a summary and conclusions are presented in Chapter 7.

1.1. Summary of Modigliani and Miller and of Traditional Positions¹

In order to understand the M & M propositions it is first necessary to understand the framework within which M & M operate. M & M take as a starting point a perfectly competitive capital market, in which all investors act rationally and in which investors, including institutional investors, are not circumscribed in their actions. Given this, M & M then assume that firms can be divided into homogeneous classes such that the business risk of all firms in a given class is the same. In other words, firms are divided into classes, such that the income generated by the assets of any one firm in a class is subject to the same degree of uncertainty as the income generated by the assets of the other firms in that class. Within this framework of perfect markets and classes of homogeneous firms, M & M then advance the following basic proposition:

Proposition I. The average cost of capital to any firm is completely independent of its capital structure and is equal to the capitalization rate of a pure equity stream of its class. (p. 268)

¹ In subsequent pages of this paper quotations from the M & M article will be followed by the page number of the article in which the quotation appears.

In equation form, this proposition reads:

$$\frac{\bar{X}_j}{(S_j + D_j)} = \frac{X_j}{V_j} = p_k$$

where:

$\bar{X}_j$ = the expected future profits of Company J in class k before deduction of interest.

S_j = the market value of the common shares of Company J.

D_j = the market value of the debts of Company J.

V_j = the total market value of Company J.

p_k = the expected rate of return on the common stock of an unlevered company in class k .

$\bar{X}_j/V_j$ is defined as the average cost of capital of Company J.

The theoretical basis of this proposition is deferred to Chapter 6, where it is presented with examples and where it is critically examined. At this point it is only necessary for the reader to note that the proposition deals with the average market capitalization rate of the firm's future income, and that the independence hypothesis is given in terms of a homogeneous-risk-class constant. From the above basic Proposition I M & M then derive the following two propositions:

Proposition II. The expected yield of a share of stock is equal to the appropriate capitalization rate p_k for a pure equity stream in the class, plus a premium related to financial risk equal to the debt-to-equity ratio times the spread between p_k and r (the interest rate). (P. 271)

Proposition III. The cut-off point for investment in the firm will in all cases be p_k and will be completely unaffected by the type of security used to finance the investment. (P. 288)

Symbolically, Proposition II can be formulated as follows:

$$i_j = p_k + (p_k - r)D_j/S_j$$

where:

i_j = the expected rate of return on the common stock of Company J.

r = the capitalization rate for sure income streams, or simply, the rate of interest.

(Note: The reader is urged to learn all of the above notations as they will appear frequently in this paper.)

In the early part of their analysis M & M abstract from the effect of income taxes and the deductibility of interest. For purposes of describing investment market behavior and rates of capitalization the introduction of income taxes does not affect Propositions I and II. That is to say, when income taxes are introduced, the rates of capitalization of Propositions I and II apply to the after-tax income available to security holders and the propositions remain unchanged. In the case of Proposition III M & M modify the original version and state that where interest is deductible the cut-off point for investment in the firm will be less than p_k when debt is used. However, in this case M & M hold that the advantages of debt financing are quite small because of the adverse effect of the debt on the market's valuation of the common shares, as given by Proposition II. Because the conclusions arrived at in Proposition III depend on the validity of Propositions I and II, only these latter propositions are examined in this paper.

It should also be pointed out that for purposes of Propositions I and II M & M define debt to include all securities senior to the common stock. At later points in this paper distinctions will be made between pure debt and debt plus preferred, but for the time being debt should be interpreted to mean all securities senior to the common stock. In addition, M & M define the expected yield of a share of stock as the expected earnings yield, and not dividend yield. This definition is also adopted in this paper, and to avoid confusion the reader should interpret the term yield to mean earnings yield (earnings-price ratio).

The proposition that the average cost of capital is independent of capital structure can be seen graphically in Fig. 1.1, below. Consistent with the hypothesis the relationship ($p_k m$) is completely horizontal at point p_k , indicating that the use of debt does not reduce average cost below the market rate of capitalization of an unlevered income stream in the same risk class. In Fig. 1.2, Proposition II is represented by the line $p_k M$, where again p_k is the capitalization rate for an equity stream for a company in class k with no debt. Note that since the average cost of capital for a company with no debt is equal to the expected yield on the common of such a company, the rates p_k in both charts have the same value ($\bar{X}/V = \bar{X}/S = p_k$). The slope of the yield-risk relation is given by $+(p_k - r)D/S$, and when r is constant (i.e., r does not increase with the debt ratio) the yield relation will be positively linear, as in Fig. 1.2. When r increases with the debt ratio Proposition II becomes a curvilinear relation, such as line $p_k M'$ in Fig. 1.2. For moderate amounts of debt, however, r is either constant or slightly rising, so that for practical purposes Proposition II may be

taken to mean that the financial-risk premium required by investors increases by a constant amount for moderate amounts of debt.

In contrast to the M & M hypothesized relationships, traditional finance holds that the use of moderate amounts of debt will tend to reduce the over-all cost of capital to a firm. This view is implicit in

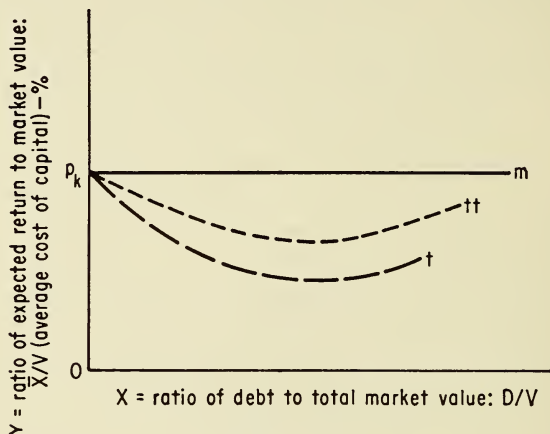


Figure 1.1

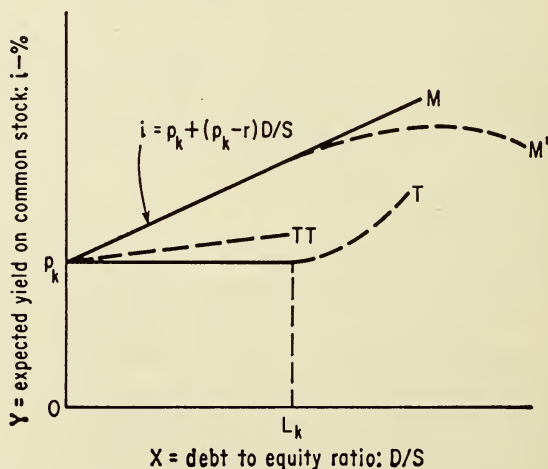


Figure 1.2

any statement to the effect that debt funds are cheaper than equity funds—and such statements have been, and still are, quite common among writers in finance. To see this it is only necessary to realize, as indicated earlier, that the use of debt by a firm will not only result in a certain cash cost for interest, but will also introduce the possi-

bility of a depreciation in the market value of the common stock because of the added risk. That is to say, the use of debt by a firm raises the possibility that the market yield of its stock will go up in order to compensate investors for the added risk. Any depreciation in quality and increase in yield in the common stock which might accompany the use of debt should clearly be regarded as a part of the cost of debt. Therefore, the statement that debt funds are cheaper than equity funds carries the clear implication that the interest rate of the debt, plus the increased yield on the common, together on a weighted average basis, will be less than the yield which existed on the common before financing. In other words, the statement, which is common in standard finance texts, implies that the weighted average cost of capital will go down as debt is used.

⊙ Graphically, the traditional view that debt funds are cheaper than equity funds is represented by line $p_k t$ in Fig. 1.1. As can be seen, the average cost of capital decreases as relatively more debt funds are employed. Beyond a certain point, however, the over-all cost of capital begins to rise as the stock and bond yields rise substantially because of the risk. The earnings yield relation which is implicit in the traditional view is represented by the line $p_k T$ in Fig. 1.2, which is also presented in the M & M paper. This line is horizontal up to point L_k , which may be regarded as some conventional debt limit for class k firms, and thereafter turns up sharply in reflection of the substantial risk presented by the debt. Note that, in contrast to the M & M yield relation, the line representing the traditional view does not decline as debt becomes very high. Implicit in this is the view that increases in debt reduce the quality of a stock and that greater compensation in the form of higher yield is required by investors.

The horizontal yield relation up to point L_k in Fig. 1.2 implies that no additional yield on the common is required as debt is utilized up to the conventionally regarded safe debt limit. Actually, the traditional view is not so well defined as implied by the line $p_k T$.¹ Some writers imply a horizontal yield relation up to a certain point while others imply instead a slightly rising yield curve.² Such differences,

¹ Cf., J. Fred Weston, "The Cost of Capital: A Restatement of the Traditional Position," Unpublished Manuscript, U.C.L.A., 1961.

² In their second edition of *Security Analysis* (1941), Graham and Dodd hold that the yield relation is perfectly horizontal up to a certain point (pp. 541-42). In their revised edition (1951), they changed their view somewhat and stated that they felt that some premium would be required for stocks of levered companies, but not so much as to keep the total market values of levered and unlevered companies the same (pp. 464-67).

however, are not particularly important for theoretical purposes, inasmuch as a number of different yield curves can be consistent with a declining *ACC* curve. Thus, a linear relation such as $p_k TT$ in Fig. 1.2 would be consistent with a declining *ACC* curve, although in this case the advantages of debt would be somewhat less. With a yield relation for class k firms like $p_k TT$, the *ACC* relation would take approximately the form of line $p_k tt$ in Fig. 1.1. In any event, the real theoretical question is not whether the yield relation is perfectly horizontal or slightly rising, but whether or not the *ACC* curve declines at all as debt is used. The traditional view holds that it does; M & M hypothesize complete independence.¹

Before going on to examine the concept of financial risk one additional point should be developed. Specifically, it will be noted that the X variable on the chart in Fig. 1.1 is the ratio of the market value of debt (D) to the market value of the firm (V). In the yield relation, however, the X variable is the ratio of the market value of debt (D) to the market value of the common shares (S). Now if the X variable on the yield chart is changed to D/V —i.e., the same ratio as in Fig. 1.1—the shapes of the yield curves will be different from those in Fig. 1.2.² Thus, when the M & M linear yield relation is put on a chart with D/V as the X variable, the relation will take the shape of the line indicated in Fig. 1.3. It will be noted that the shape of the line in Fig. 1.3 bears some resemblance to line $p_k T$ in Fig. 1.2, which

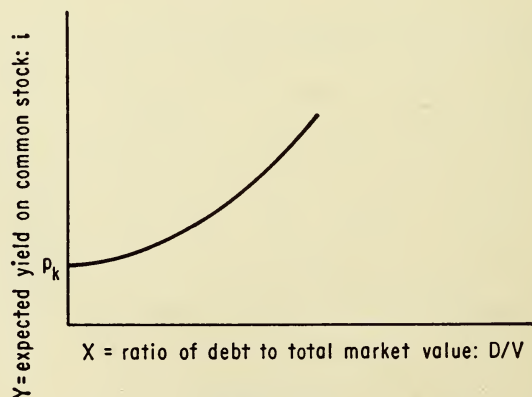


Figure 1.3

¹ Another way of putting this is that M & M deny the existence of an optimum capital structure.

² This will be the case because the D/S ratio and the D/V ratio are not linearly related.

M & M, in their paper, use as an approximate representation of the traditional view.

Recognition of the above curvilinear relationship has led Professor J. Fred Weston to conclude that the M & M yield hypothesis is not really inconsistent with traditional beliefs after all. In other words, because the M & M yield relation rises slightly at first and then sharply when put on a D/V scale, Professor Weston concludes that the two views are not really at odds. In a recently published article he states: ¹

Thus, Proposition 2 of Modigliani and Miller reinforces traditional theory rather than controverts it. (p. 135)

At a later point in his article he states:

However, in terms of establishing their underlying propositions, in my judgment they have essentially failed on Propositions 1 and 3. The general form of Proposition 2 is valid and is consistent with traditional theory. (p. 138)

In the opinion of the present writer the above two statements by Professor Weston reflect (1) two different conclusions; and (2) a slight misunderstanding of the real nature of the difference between the M & M and the traditional views. It may be somewhat difficult for the reader to appreciate this statement at this point of the paper, as the derivation of Proposition II has been deferred to a subsequent chapter. At this point, though, it is only necessary to point out that the M & M Proposition II is derived from their Proposition I and that, as indicated earlier, the M & M yield relation is very rigidly defined. On this basis it is the opinion of this writer that (1) acceptance of Proposition II automatically means acceptance of Proposition I because II is derived from I; and (2) Proposition II, because it rigidly defines the yield relation, neither reinforces nor is consistent with traditional theory—no matter what form it is put in. The above conclusion by Professor Weston was apparently reached by him in an attempt to develop some kind of reconciliation between the M & M and the traditional views. However, for the reasons stated it is the opinion of this writer that there is no basis for reconciling the two

¹ The above passages can be found in Professor Weston's article, "The Management of Corporate Capital: A Review Article," *Journal of Business*, April 1961. The conclusions expressed in the above passages and the results of his more detailed analysis also appear in an unpublished paper, "The Cost of Capital: A Restatement of the Traditional Position," U. C. L. A., 1961.

views. The two views are very much opposed: the one says that debt is cheap and the other says that it is not.

While this writer disagrees with Professor Weston's first passage, it is felt that there is an element of truth in his second passage, which can avoid confusion in another direction. Thus, in his second passage Professor Weston states that "the general form of Proposition II is valid and is consistent with traditional theory." Now, to say that the *general form* of Proposition II is consistent with traditional theory is quite a different thing from saying that Proposition II reinforces traditional theory and is consistent with it. The general form of Proposition II, on the assumption of a constant r , is linear when plotted on a D/E scale. In this connection it was pointed out earlier that a number of different yield curves could be consistent with a declining *ACC* curve—including a positive straight line with less slope than the *M & M* line. If such a straight line were plotted on a D/V scale then the relation would become curvilinear, increasing slightly at first and then sharply. Thus, the *general form* of Proposition II— i.e., a straight line with a positive slope—can be consistent with the traditional view if one holds that the traditional view is a line which rises slightly at first and then sharply. This writer prefers to say that it *can be* consistent rather than it *is* consistent, first, because a curved line on a D/S scale will also result in a curved line on the D/V scale, and, second, because it is not felt that the yield relation in the traditional view is that well defined. The traditional view holds that debt is "cheap" and that the *ACC* curve will decline, and such a view can be consistent with a yield relation which is either a straight line or a curved line on either a D/S scale or a D/V scale.

CHAPTER 2

Definition of Financial Risk

Before discussing the empirical results presented by M & M and by this investigator it will be necessary to first look carefully at the concept of financial risk. The M & M Proposition II which was discussed in the preceding chapter is essentially a hypothesized description of the way investors respond to the risks introduced by debt financing. In order to measure these risks, therefore, and to determine the validity of the proposition vis-à-vis the yield relation implied in traditional views, it is essential that a clear picture of these risks exists. Furthermore, it is important that the risks arising from debt be distinguished from the normal economic risks of a company. In this connection it should be noted that in their paper M & M refer to the risk which arises from debt as "financial risk." This term has been given other meanings by other writers.¹ For purposes of this study, however, the reader is urged to abstract from these other meanings to avoid confusion. The choice of term is not important in itself; what is important is the picture of the debt risks.

An idea of the meaning which M & M attach to the term financial risk can be obtained from the following passage which appears in their paper:

Because firms may have different proportions of debt in their capital structure, shares of different companies, even in the

¹ See, for example, the following: Howard and Upton, *Introduction to Business Finance* (New York: McGraw-Hill, 1953), p. 19; Harry C. Sauvain, *Investment Management* (Englewood Cliffs, N. J.: Prentice-Hall, 1953), p. 98; Robert W. Mayer, "Analysis of Internal Risk in the Individual Firm," *Analysts Journal* (November 1959), p. 92.

same class, can give rise to different probability distributions of returns. In the language of finance, the shares will be subject to different degrees of financial risk or 'leverage' and hence they will no longer be perfect substitutes for one another. (p. 268)

The notion of perfect substitutes will be explained shortly, but three things should now be observed from the foregoing passage. First of all, it will be noted that M & M not only associate financial risk with leverage, but they *equate* the two. At later points in this paper the appropriateness of this procedure is questioned, but for the time being, for simplicity, financial risk and leverage may be treated synonymously. Secondly, it will be noted that the risk which does arise from leverage is manifested by different probability distributions of returns to shareholders. Finally, it will be noted that M & M do not specifically indicate how debt influences the probability distributions of returns to shareholders. At a later point in this paper the effect of debt on the probability distributions of shareholders is explored in some detail. At this point, though, all that is necessary is a general picture of the effect, and this can be obtained by considering the concept of a homogeneous risk class.

M & M define a homogeneous risk class as a group of firms whose expected average income generated from *assets* is subject to the same degree of business risk, or uncertainty. This concept of homogeneous risk class can be explained in several different ways, and in this chapter a description is given which is somewhat different from that given by M & M, although it is essentially the same. This procedure is followed because the M & M description does not lend itself too well to a description of the risks for individual firms. As a starting point, then, it will be helpful to note that a number of measures can be used to indicate the risk which attaches to the expected average income from assets of a given firm. One of the simplest measures which could be used is the range of a probability distribution of average returns. Another measure which could also be used is the standard deviation of such a probability distribution. Both of these measures would give some idea of the dispersion of the probable average income of a firm. These two measures, however, are deficient in that they only give an idea of the absolute risk and ignore the fact that firms differ in size; to this extent they do not permit a fair comparison of risk between firms. Two firms, for example, could have a range of probable incomes of \$10,000, but it would be one thing if this range accompanied an

expected average income from assets of \$20,000 and another thing if it accompanied an expected average income of \$200,000. To permit comparison of risk between firms, then, the measures of dispersion should be put in relative terms. This can be done most easily with the coefficient of variation, where:

$$\text{Coefficient of Variation} = CV = \frac{s}{\bar{X}}$$

and where:

$\bar{X}$ = the expected average future income generated from assets.

s = the standard deviation (variation) in the probability distribution of average income from assets.

Using the coefficient of variation for comparison of risk between firms, then, one characteristic of firms in a homogeneous risk class is that CV is the same for all firms. In other words, when CV is the same for all firms in a class, the expected average incomes from assets will be subject to the same *degree* of uncertainty.¹ Now if all companies in a class were debt-free the shares of firms in the class would be perfect substitutes for each other. This would be the case because for debt-free firms the risk of the expected returns to shareholders would be the same as the risk of the expected returns from assets, and this risk is the same for all firms in a class. For debt-free firms:

$$CV = \frac{s}{\bar{X}} = \frac{s_c}{\bar{X}_c}$$

where:

$\bar{X}$ and s are the same as before.

$\bar{X}_c$ = the expected average future income for the common shareholders.

¹ M & M explain a class in the following way: The average future income (X) of a company is a random variable with an expected average value of ($\bar{X}$). If the average future income is taken as a ratio of the expected value ($X/\bar{X}$), then the probability distribution of this ratio will be identical for all firms in a class. In other words, the parameters of the probability distribution of that ratio, including the mean, will be the same for all firms. What M & M have done is to change the scale of the probability distribution of average returns so that comparisons can be made between distributions with a mean of unity. The formulation given above, in contrast, permits comparison between companies, but the original probability distributions with their means are retained. This approach will be more convenient in later parts of this paper, when probability distributions for hypothetical firms are presented.

s_c = the standard deviation in the probability distribution of average income for the common shareholders.

In contrast to the above case of no debt, if a firm has debt, then the expected average income for shareholders will be subject to a greater degree of risk than the income from assets of that firm. This will result because of the relatively wider range of probable incomes because of the "gearing." Symbolically, for the case of firms with debt:

$$\frac{s_c}{\bar{X}_c} > \frac{s}{\bar{X}}$$

The increase in *CV* for the shareholders of levered firms gives a general picture of the effect of debt on shareholder probability distributions. This interpretation is also shown graphically in Fig. 2.1, which presents the hypothetical case of two firms, A and B, which were assumed to have, for simplicity, the same expected average income from assets. The *Y* variable in the chart represents the possible values which the *average* future income might take, while the *X* variable represents the probabilities of the various incomes. The expected average income for both companies has been assumed to be \$10,000 while the limits within which the actual average might fall are \$5000 and \$15,000. The probability distribution of average income from assets for both firms is represented by curve A; thus, both companies are in the same risk class. Now if Company A is assumed to have no debt then the probability distribution of average returns to shareholders will be identical with curve A. On the other hand, if Company B has debt, the probability distribution of returns to shareholders must be shifted down to the extent of the amount of payments to senior security holders. In Fig. 2.1 it was assumed that such payments were \$4000, and the curve (*B*) was shifted down accordingly. Note that while both curves have the same absolute range (\$10,000), the dispersion relative to the expected income is much greater for the *B* curve. This relatively greater dispersion is due to leverage and constitutes the financial risk of Company B. It is in this sense that the term financial risk is used in this paper, and the reader is urged to become familiar with it. Failure to appreciate the distinction between financial risk, business risk, and other risks will result in an important misunderstanding.

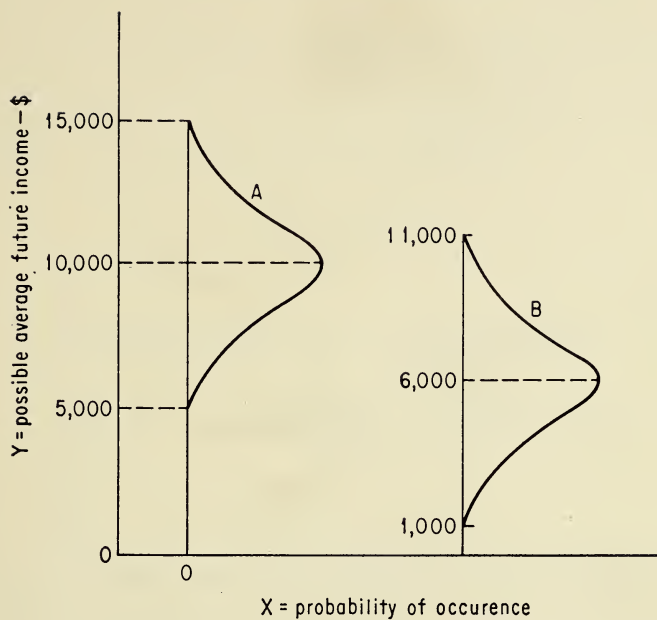


Figure 2.1

CHAPTER 3

Evaluation of Modigliani and Miller Statistical Tests

The evidence presented by Modigliani and Miller in support of their hypotheses consists of two separate and independent studies made prior to the formulation of their hypotheses. The first consists of a study of yields and cost of capital for 43 large electric utilities by F. B. Allen in 1954.¹ The second consists of a study of yields and cost of capital for 42 oil companies by Robert Smith in 1955.² Certain modifications were made to the data of these studies by M & M, and using the data in modified form M & M applied a number of statistical significance tests to check the validity of their hypotheses.

As is probably known to most readers, the results of these tests proved favorable to the M & M hypotheses and tended to discredit traditional views. Specifically, the tests for both sets of data showed that average cost of capital did not correlate with financial structure and that the relationship between the two was horizontal, as predicted by their Proposition I. The yield tests for both sets of data showed that yields were linearly and positively correlated with financial risk, as measured by the debt-to-equity ratio, and that within sampling limits the slopes of the curves were consistent with what would have been predicted by Proposition II. By way of review, Figs.

¹ "Does Going Into Debt Lower the 'Cost of Capital'?", *Analysts Journal*, August 1954, Volume 10, Number 4:57-61.

² "Cost of Capital in the Oil Industry," (hctograph). Pittsburgh: Carnegie Institute of Technology, 1955.

3.1 and 3.2 have been prepared to show the approximate shapes and slopes of the lines achieved for both industries. The X and Y variables in the figures are those used by M & M and correspond to the X and Y ratios of Figs. 1.1 and 1.2, except that current and average earnings were used as an approximation to future earnings.

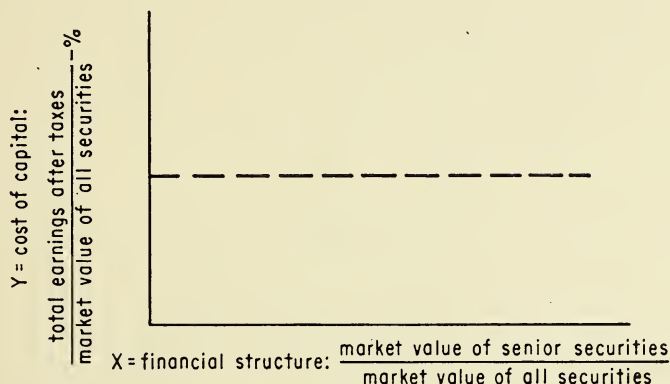


Figure 3.1

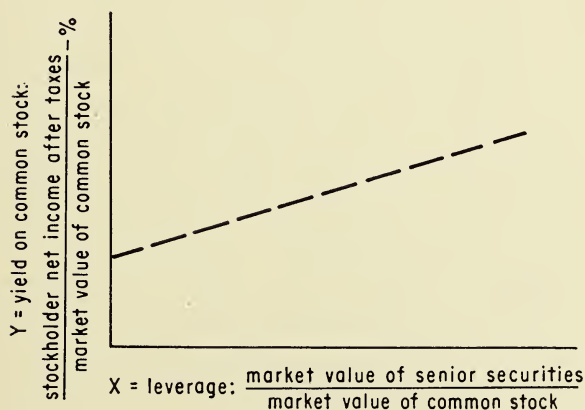


Figure 3.2

The data and tests presented by M & M have been criticized by a number of people on a number of different grounds. In the case of the utility sample, for example, the data have been criticized on the grounds that there are insufficient observations over certain ranges of capital structure to justify drawing inferences about the shape of the

relations over the entire range.¹ Thus, in the utility sample only eight observations have debt-to-total market value ratios between 0% and 50%, and the bulk of the observations fall within the range of 50% and 80%. If a soupbowl-shaped *ACC* curve in fact existed for utilities, it would be very difficult, if not impossible, to observe a decline in the curve with so few observations below 50%. Furthermore, with such a large concentration of observations between 50% and 80% and with the normal variation which exists, it would not be unexpected to obtain a horizontal *ACC* line. The oil industry sample is not subject to this criticism as the observations are spread out fairly evenly over the lower and middle ranges. However, in the case of the oil industry the sample has been criticized on the grounds that the observations are too diverse and do not come near approximating a homogeneous risk class, as required by Propositions I and II. Thus, differences in markets, products, earning power, and properties raise serious doubts about whether the oil companies can be regarded as a reasonably homogeneous risk class. Furthermore, the use of current earnings as a reasonable approximation to expected future earnings is open to serious question. Stock values may reflect the value of oil properties and reserves which are not currently contributing to earnings but which may be expected to contribute substantially to future earnings.

The above criticisms of the M & M tests are valid criticisms, but they do not completely discredit the tests. The problems encountered by M & M in their tests will in all probability appear in other similar studies, and to a certain extent they appear in the tests to be presented at a later point in this paper. However, the problem of data is one of degree, and it is felt that while the above criticisms do not discredit the tests, the problems of heterogeneity and insufficiency of observations over relevant ranges are sufficiently great in oils and utilities to weaken the tests and make them less convincing.

A more serious criticism of the M & M tests is the existence of bias. In footnotes to their paper M & M admit the possibility of bias against the traditional view because of the use of the same variable in the denominator of the ratios on the *X* and *Y* axes.² Nevertheless, while they admit the possibility, they do not indicate specifically how the bias might arise in tests of the kind conducted. It is the opinion

¹ Cf. J. Fred Weston, "The Management of Corporate Capital: A Review Article," *Journal of Business* (April 1961), pp. 135-36.

² *Op. cit.*, notes 38 and 42, pp. 284 and 287, respectively.

of this writer that bias does exist in the M & M tests and that the bias is sufficiently great to cast serious doubt on the meaning and validity of the tests. The remainder of this chapter will be devoted to indicating specifically how the bias arises and the circumstances under which tests of the kind conducted by M & M will not be significantly biased against the traditional view. In examining the way the bias arises, it will be helpful if attention is focused on the yield relation tests. The bias also exists in the average cost of capital tests, but because the average cost variable is a weighted average the bias is not so easily seen as in the case of yields. It will also be helpful to digress briefly at this point to say a few words on correlation methodology.

In correlation analysis one usually works with samples of heterogeneous observations, that is, observations which reflect the influence of many different variables. This is not always true, but it is frequently the case in social sciences such as business and economics, where very homogeneous observations in large numbers simply do not exist. Given, then, a somewhat heterogeneous sample, if one wishes to observe the relationship between any two variables in a correlation analysis, he hopes that the effect of variations in other variables not considered will cancel out in such a way that the observed relationship will be reasonably close to the true relationship which exists in the population. This process of canceling out will in effect result in a line of relationship which exists when the other variables influencing the data are at approximately their average value. This will not always be true, for there is the question of the size of the sample and the extent of the heterogeneity. Nevertheless, if the sample is of a reasonable size and the heterogeneity not too great, it seems safe to conclude that the line of relationship which is obtained between two variables will be that line which exists when the other variables are at about their average value. An illustration will help to make the point clearer. For example, it is well known that the stock yields of small companies are typically higher than the stock yields of larger companies. Suppose, then, that one wished to determine the relationship between yield and debt-to-equity for a large number of firms of varying size in a given industry. If a scatter diagram were prepared, the location of the yields of the small firms, relative to the location of the yields of the large firms, would probably be about as indicated in Fig. 3.3 below.

As will be noted from Fig. 3.3 the relationship between yield and

debt-to-equity will be relatively high for smaller firms just by virtue of their smaller size. This relationship has been indicated by line *S* in the figure. In contrast, the line of relationship for the larger firms should be at a lower level, and this has been indicated by line *L* in Fig. 3.3. Now, when a line is fit to all of the observations without taking into account size, the effect of variations in size will tend to cancel out (though not perfectly), and the line which is obtained will be the relationship between yield and debt-to-equity for the medium-sized firm. This line is line *M* in Fig. 3.3. In an unbiased test canceling of the sort indicated in Fig. 3.3 should occur.

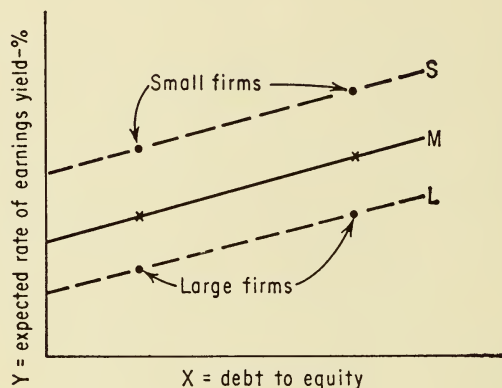


Figure 3.3

What are the heterogeneous factors which cause variation in yields in a sample of firms taken to represent a homogeneous risk class, as defined by M & M? There are probably many; several of the more important ones can be listed, with reasons, as follows:

1. *Business Risk*: An attempt to control variation in yields due to variation in business risk is made when an industry is selected as an approximation to a homogeneous risk class, as defined. The reasoning is that companies within an industry will be more homogeneous with respect to business risk than a group of companies selected at random from a heterogeneous list of companies. While the reasoning is valid, it is probable that there will still remain a substantial amount of variation in business risk within the sample, by virtue of the fact that firms serve different geographical markets, if for no other reason. However,

within an industry firms also usually differ in the price market served, in the degree of product diversification, in product quality, in the quality of management, and other things. Accordingly, even firms within an industry will vary in business risk, and investors will respond to such variations by requiring different risk premiums for the companies within the sample.

2. *Degree of Market Imperfection:* The yields of stocks within an industry will also vary because of imperfections in the capital markets—that is, because of imperfect knowledge on the part of investors and because of institutional restrictions. Thus, stocks traded over-the-counter may suffer adversely because they are not known to investors. Imperfect knowledge may also inhibit banks and brokers from lending on over-the-counter issues; such lenders, however, will usually lend on listed stocks. In addition to imperfect knowledge, the presence of restricted lists for fiduciaries and savings banks tends to concentrate institutional common stock money in only a limited group of stocks. Stocks on eligibility lists might well have substantially lower yields even though their risk characteristics differ only slightly from the noneligible stocks. To a certain extent variation in yields due to imperfection in the market can be controlled through the selection of the sample. But even when the sample is carefully selected there is bound to be some variation because of this factor.
3. *Dividend Policy:* Companies within an industry will have different dividend policies. The effect of dividend policy on earnings yields is a subject of current debate. Whatever the precise effect, however, there is probably some effect, and the sample yields will reflect this.
4. *Errors of Measurement:* Errors in the measurement of average market prices will result in variations in stock yields. The use of current (or average) earnings as a proxy for expected future earnings will also introduce errors and cause variations in stock yields. The errors introduced by using current earnings as a proxy for future earnings can be both systematic and random. Systematic errors will result, for example, when a growth industry has been selected for study. In such a case there will be a tendency for all firms to have current earnings which are low relative to expected future earnings. Random errors will occur

because some companies will be growing at a greater rate than the average while others will be growing at a smaller rate than the average.¹

5. *Size*: There is good evidence that yields vary with size. There are probably a number of reasons for this. First of all, size may be related to business risk, with the smaller, less-diversified companies being more risky. Secondly, stocks of large companies may be better collateral and for this reason may be more attractive. Third, size may be related to growth. Finally, investors might just have a preference for holding shares of large, well-known companies.

The foregoing list gives some idea of the causes of variation in the yields of a sample of firms selected to approximate a homogeneous risk class. The reader can doubtless think of other factors which influence yields. The presence of heterogeneity of the kind indicated, however, is not a sufficient basis for discrediting a test. What is important is the way variations in these heterogeneous factors affect the regression line. Thus, will the effect of variations in the many variables affecting yield cancel out in such a way that the regression line obtained reflects the true relationship between yield and financial risk, as defined? When market-value debt/equity ratios are used as the measure of financial risk—which is what M & M use—it is felt that the answer to this question is no. The procedure which will be used to demonstrate this consists of taking three hypothetical situations in which all variables are held constant except one. The effect of variation in the uncontrolled variable is then examined. In a later chapter actual evidence will be presented which reinforces the conclusions suggested by the hypothetical demonstrations.

Situation 1. Two firms are assumed to be identical in every respect except in the market in which they sell their products. Both firms are the same size in sales and assets and both firms sell the same product. Both firms have the same book-value debt ratio, the

¹ It should be mentioned that the systematic errors mentioned above are of no importance for the yield and average cost tests. The reason for this is that the systematic errors will affect only the level of the regression lines, and this is of no concern in the testing of the propositions. The concern is with the shapes and slopes of the regression lines, and there is no reason to believe that these will be affected by the systematic errors.

same interest charges, and the same rate of return on book value. Additionally, both firms have the same current earnings, and in each case the current earnings are equal to the expected future profits. In sum, both firms are identical in all respects except in the geographical market they serve. Because of the difference in markets, however, the firms are subject to a different degree of risk. Firm A is assumed to serve a less risky market while Firm B is assumed to serve a more risky market, such as might be true of a foreign market, or a domestic market in which defense industries are important. What this means is that Firm B will have a wider probability distribution of returns from assets than Firm A even though the expected values of the two probability distributions are the same. By the criterion set up by M & M these two firms belong in different risk classes. Finally, because of the greater risk of Firm B it is assumed that investors require a greater yield on the stock of Company B. The figures assumed for debt, equity, common earnings, and yield are given below. The derived market-value debt/equity ratio is also given.

	<u>A</u>	<u>B</u>
Book equity	\$200	\$200
Book debt (equal to market value)	\$100	\$100
Book debt/equity ratio	50.0%	50.0%
Net earnings for common	\$30	\$30
Market rate of capitalization (yield)	10.0%	15.0%
Market value of common equity	\$300	\$200
Market value debt/equity ratio	33.3%	50.0%

When the yields of Companies A and B are plotted against the market-value debt/equity ratios the situation that will obtain can be seen in Fig. 3.4. Note the relative position of the two points: the firm with the higher yield is higher up on the X -scale, relatively, than the firm with the lower yield. What appears to be a variation in yield because of differences in financial risk is in fact a variation due to differences in business risk; that is, the firm in the more risky class (p_1) appears at the higher end of the scale while the firm in the less risky class (p_k) appears at the lower end of the scale. Thus, there has been no effective canceling of the effects of variation in business risk. The situation that will obtain when book-value debt/equity ratios are used as the measure of financial risk can be seen in Fig. 3.5. In this case there is an offsetting of the two yields at point x , which would be the approximate location of a firm with business risk in between that of A and B.

Situation 2. In this situation two firms are assumed identical except in scale. Firm A is ten times the size of Firm B, but the two firms sell the same product in the same market, so that their business risks are identical. However, because Firm B has a smaller capitalization its shares are traded over-the-counter. The shares of Firm A are listed

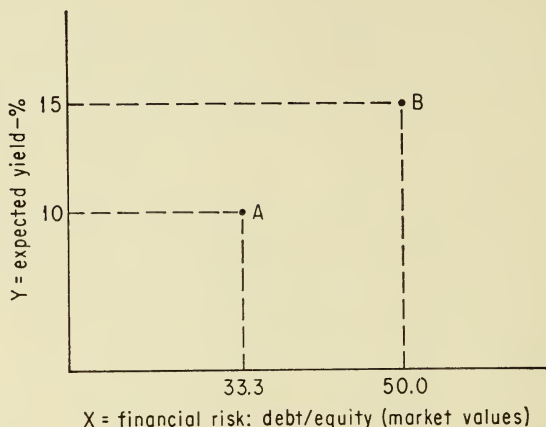


Figure 3.4

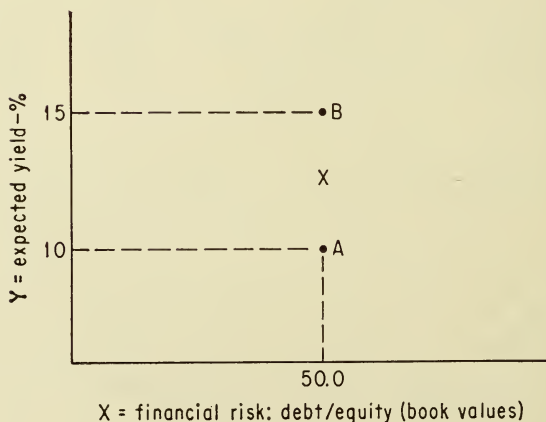


Figure 3.5

on an exchange and are traded actively. Because of investor preference for stocks of large, listed corporations (for status reasons or for liquidity reasons) it is assumed that investors will pay a higher price for the earnings of the larger firm. The debt, equity, earnings, and

yield figures assumed are given below. The derived market-value debt/equity ratios are also given.

	<u>A</u>	<u>B</u>
Book equity	\$2000	\$200
Book debt (equal to market value)	\$1000	\$100
Book debt/equity ratio	50.0%	50.0%
Net earnings for common	\$300	\$30
Market rate of capitalization (yield)	10.0%	15.0%
Market value of common equity	\$3000	\$200
Market value debt/equity ratio	33.3%	50.0%

When the yields of Companies A and B are plotted against the market-value debt/equity ratios the situation that will obtain will be identical to that shown in Fig. 3.4. In this case, however, what appears to be a variation due to differences in financial risk is in fact a variation which has nothing to do with it, since the firms are assumed identical except for scale. But the same tendency which was observed in Situation 1 appears here, namely, the firm with the higher yield appears at the upper end of the scale while the firm with the lower yield appears at the lower end of the scale. When financial risk is measured by the book debt/equity ratio the situation that will obtain will be identical to that shown in Fig. 3.5. As before, there is an offsetting, but this time it is an offset of a variation due to market imperfection.

Situation 3. In this third case two firms are assumed identical except for growth rate. The two firms are currently the same size and have employed the same amount of debt, so that their book debt/equity ratios are the same. The current rate of earnings is also the same, but because of a more aggressive management the earnings of Firm A are expected to be substantially better in the future—relative to its current earnings and relative to the future earnings of Firm B. It is assumed for simplicity that investors capitalize the future earnings of both companies at the same rate; a slightly higher *P-E* ratio could be assumed for Firm A because of the superior management, but for the purposes of the demonstration it will not make any difference. The assumed debt, equity, earnings, and yield figures are given below. The derived figures are also given.

When the current yields are used as a proxy for expected yields the situation that will obtain when the yields are plotted against the market-value debt/equity ratios can be seen in Fig. 3.6. As before, the firm with the higher yield appears at the upper end of the scale

	<u>A</u>	<u>B</u>
Book equity	\$70,000	\$70,000
Book debt (equal to market value)	\$30,000	\$30,000
Book debt/equity ratio	42.9%	42.9%
Current earnings for common	\$10,000	\$10,000
Expected earnings for common	\$13,000	\$7,000
Capitalization rate of expected earnings	10.0%	10.0%
Market value of common stock	\$130,000	\$70,000
Current yield	7.7%	14.3%
Market value debt/equity ratio	23.1%	42.9%

while the firm with the lower yield appears at the lower end of the scale. What appears to be a variation in yield due to financial risk is in fact a variation due to different growth rate, superior management, and the error in estimating future earnings with current earnings. Had a greater valuation been placed on the earnings of Firm A because of the superior management, the observed variation would be even more pronounced. When book-value debt/equity ratios are used as the measure of financial risk the variations due to growth rate and earnings error tend to offset. This can be seen from Fig. 3.7.

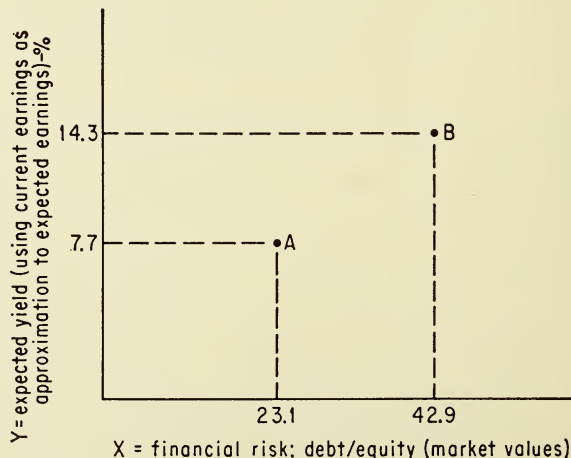


Figure 3.6

In the three hypothetical situations presented above the effect of variation in variables other than financial risk was examined by artificially holding all variables constant except one. In each case it was

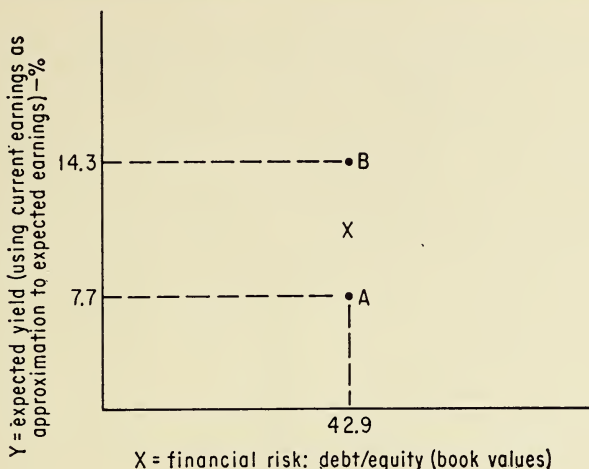


Figure 3.7

found that variation in the uncontrolled variable did not result in a random variation when the market-value debt/equity ratio was used as the measure of financial risk. Instead, a systematic variation resulted from the uncontrolled variable, with the high-yield observation being higher on the X -scale relative to the low-yield observation. Similar tests allowing other variables to vary would produce similar results. With all heterogeneous factors pulling in the same direction, therefore, there is serious question as to whether a yield test using actual data and market-value debt ratios would be unbiased. The systematic variation would also tend to appear in the average cost of capital test when market-value debt ratios are used as the measure of financial structure. Companies with low-yielding stocks will tend to appear on the lower end of the X -scale, relative to the high-yielding stocks.

The question of the bias in the M & M yield tests can also be viewed from a different standpoint, namely, from the standpoint of causation. In placing yield on the scatter diagram as the dependent variable and market-value debt/equity as the independent variable, M & M imply that changes in market-value debt/equity ratios cause changes in the expected, or required, yield. This implication is clear, for market-value debt/equity is taken as a measure of financial risk, and yields are supposed to respond somehow to changes in financial risk, among other things. But the use of the market-value debt/equity ratio as the independent variable is subject to question, and if there

is in fact a causal relationship between yield and market-value debt/equity, it is probably the opposite of what M & M imply. The reasoning behind this is not difficult to grasp. Thus, the denominator of the market-value debt/equity ratio is determined by the market value of the common stock. The market value of the common stock, in turn, is determined by the net earnings for the common divided by the market rate of capitalization, i.e., the market yield. Changes in yield, therefore, will cause changes in the market-value debt/equity ratio. To argue that changes in the market-value debt/equity ratios cause changes in the market yields, one would have to hold that: (1) the market-value debt/equity ratios are in fact used by investors (i.e., the ratios influence investor decisions); and (2) the use of the market-value ratios is widespread. As will be indicated at a later point in this paper, there is a basis for believing that neither of these conditions is actually the case.

From the standpoint of causation, then, the two variables used by M & M are probably better in reverse position. When this is done, the positive linear relationship between yield and financial risk becomes a positive linear relationship between market-value debt/equity and the market rate of capitalization of the common earnings. This can be seen in Fig. 3.8. Note that in addition to the rate of capitalization of common earnings, the market-value debt/equity ratio also depends on the amount of earnings for the common shareholders and the market value of the debt. These in turn depend on the rate of return earned on book assets, the amount of book leverage employed, and the coupon of the debt vis-à-vis current interest rates. Thus, the greater the de-

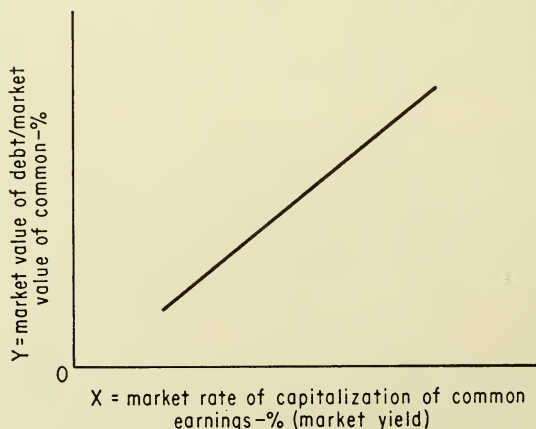


Figure 3.8

gree of homogeneity in these factors for a group of companies, the greater will be the degree of correlation in the observed relationship. The greater the heterogeneity, the smaller will be the observed r .

The statement that changes in market rate of capitalization will result in changes in market-value debt/equity ratios requires one qualification, namely, there must be some debt. If debt is zero then there is complete independence between the market-value debt/equity ratio and the market rate of capitalization. In other words, the capitalization rate could vary over the entire range of values, but if debt is zero the market-value debt/equity ratio will stay at zero, for the numerator of the ratio will be zero. From an empirical standpoint this means that if there are a number of observations with zero debt, there is a good chance that a yield test using market-value debt/equity as the measure of financial risk will not be significantly biased against the traditional view. This is illustrated in Fig. 3.9. In Fig. 3.9 the general relationship between the market-value debt/equity ratio and the capitalization rate for firms with debt is shown in the center of the chart (line *B*). Along the *X*-axis are shown a series of observations with zero debt and with, therefore, zero market-value debt/equity ratios. A least-squares line fit to all of the observations would show a low correlation coefficient (line *A*). Thus, there are circumstances when a biased test could be consistent with traditional views regarding financial risk and yield.

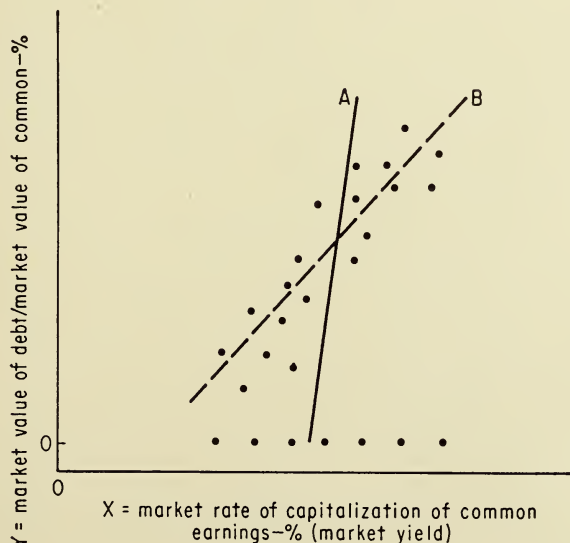


Figure 3.9

CHAPTER 4

Methods of Investigation

4.1. Measurement of Financial Risk

The M & M Proposition I states that the average cost of capital to a firm is independent of the firm's capital structure. In this connection, it is generally agreed that the rate of interest paid to creditors is practically constant as small amounts of debt are employed by firms. It is also generally agreed that when moderate amounts of debt are employed the increase in interest rate paid to creditors is relatively small. If, therefore, the M & M Proposition I is true, then stock yields must increase significantly as small and moderate amounts of debt are employed. If there were no significant increase in stock yields as small and moderate amounts of debt were employed, then, with a practically horizontal interest rate function, the weighted average cost of capital would go down. The M & M Proposition II is a hypothesized description of the way stock yields increase in response to increasing debt and financial risk.

To test the proposition that stock yields increase for small and moderate amounts of debt—and indirectly the proposition that the average cost of capital is a constant—three types of measures of financial risk, or leverage, were considered, namely, market-value debt/equity ratios, coverage ratios, and book-value debt/equity ratios. Of these three measures, the market-value debt/equity ratios were rejected because of the biases associated with them. Of the remaining two, the coverage ratios were rejected because observed results using them would be too difficult to interpret.¹ This left the book-value

¹ If stock yields did not increase in response to small and moderate amounts of debt, then the relationship between yield and interest coverage would be

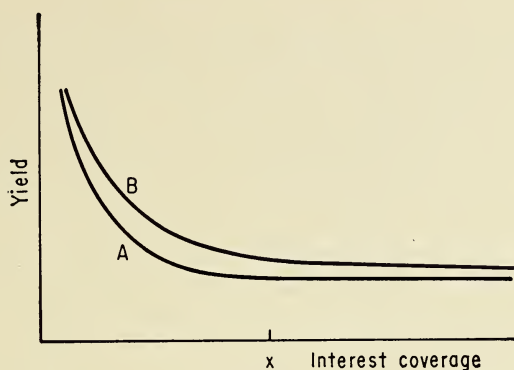


Figure 4.1

debt/equity ratios, which were finally selected as the measures of financial risk.

It was indicated earlier in this paper that in their theoretical and empirical work M & M defined debt to include all securities senior to the common stock, and that the measure of financial risk used was the ratio of senior securities to common stock (market values). The treatment of preferred as debt for purposes of measuring the amount of leverage employed by a firm is an acceptable procedure, but if what is desired is a measure of financial risk to common stockholders, the procedure is questionable. The treatment of preferred as debt ignores the fact that debt and preferred stock present different risks to shareholders. In the one case failure to meet payments means bankruptcy and possible elimination of the common shareholders while in the other case failure to meet payments presents no such risks. At a later point in this paper the different risks created by debt and preferred are explored via their effect on the probability distribution of returns to common shareholders. At this point though it is only necessary to note that when the amount of senior capital employed is small, the risks created by debt and preferred tend to be the same. But when the amount of senior capital employed is large, the risks presented by

horizontal over a wide range, as indicated by Line A in Fig. 4.1. If stock yields did increase in response to increasing debt, the relationship between yield and coverage would be hyperbolic, with one side of the curve being asymptotic to a line parallel to the X-axis. This has been indicated by Line B in Fig. 4.1. In an empirical investigation it would be very difficult, if not impossible, to determine whether the relation beyond point X (Fig. 4.1) were horizontal or asymptotic. Preliminary work was conducted along these lines, but the effort was futile.

bonds and preferred differ significantly. Consequently, two identical, high debt/equity ratios—one consisting entirely of debt in the numerator and the other consisting entirely of preferred in the numerator—could be accompanied by very different common stock risk premiums. For this reason financial risk was measured two ways in the present study—using book values in each case—and yield tests were conducted using both measures. First, it was measured by the ratio of all senior securities to the common equity; strictly speaking, this is a leverage measure. Secondly, it was measured by the ratio of pure debt to total equity; this second ratio tends to keep the debt more homogeneous.¹

The use of book values in the financial-risk measure has been criticized on two bases: first, it has been criticized as not being a direct test of Proposition II, which requires the use of market-value ratios; second, it has been criticized as not being a direct test of Proposition I, since the average cost proposition makes no prediction about the relationship between yields and book value debt ratios. While the first point is admitted, the second point is not. As developed and presented by M & M, Proposition I does not make any direct prediction of the relationship between yield and book-value debt ratios. Nevertheless, while no direct prediction is made, it is felt that a relationship between the two variables is implied by Proposition I—in a negative way. The reasoning behind this is as follows: if the interest rate function is substantially horizontal for small and moderate amounts of debt, then Proposition I implies that the relationship between stock yields and *any* unbiased measure of financial risk, or leverage, will *not* be horizontal up to the moderate debt range. Otherwise, if the yields were horizontal for small amounts of debt, then, with a horizontal interest rate function, the average cost curve would decline. There may be difficulties in interpreting observed results when book values are used, and there may be questions as to whether book-value ratios are unbiased, but these are different questions. The implication of Proposition I is still there.

It is possible that the use of book-value ratios in the measurement of financial risk will result in a biased yield test, but this writer is unaware of any bias which might result. Looking at the book ratios more positively, there are a number of reasons why their use could be

¹ It can be shown that, under certain conditions, an empirical relation could support the M & M yield hypothesis solely because of heterogeneous senior securities in the sample, and not because the hypothesized relation is true.

advocated in yield tests. In the first place, the demonstrations in the preceding chapter suggest that when book-value ratios are used as the risk measure, heterogeneity in the data will not result in a systematic variation in the yields, as it does when market-value ratios are used. This is a very important consideration in the selection of a risk measure. Errors may occur with the book-value ratios because of variations in accounting practices, but it is not apparent that these errors introduce a bias in the testing procedure. In the second place, book-value debt ratios are ratios which can be controlled by financial management in the interests of maximizing the shareholders' wealth. Thus, as a by-product, knowledge of the effect of book debt ratios on stock yields would provide financial management with something useful.¹ Finally, book-value debt ratios as measures of financial risk are measures which are relevant—relevant in the sense that investors look at them and study them. This is a particularly important consideration, for yields are not abstract quantities. Yields are determined by people, and what we wish to determine in the statistical tests is whether investors react to changes in a certain variable called financial risk in a certain hypothesized way. To do this effectively one must use measures which investors use. The book debt ratios, which are reported regularly in the large financial statistical services, meet this criterion.²

4.2. Selection of Samples

For purposes of conducting yield and average cost tests three samples with somewhat different characteristics were studied, namely, Class I railroads, department store companies, and cement companies. The procedure for selecting the observations for study consisted of taking the complete list of companies in these industries, as provided in *Moody's*, and determining which companies had market valuations for their common stocks in 1956. Companies with no market valuations for their common stock were excluded from study, as were com-

¹ It should be noted, in contrast, that the market-value debt ratios are not easily controlled by management, and therefore are not very relevant for management purposes. This point was recently made to the writer by Professor William Beranek (University of Wisconsin), who is currently conducting studies on the maximization of shareholder wealth.

² See Appendix B for the results of a small study on the methods of analysis used by nine institutional investors.

panies with losses, which could not be adequately dealt with. In addition to these, certain companies which were clearly not comparable with the others in their group were also excluded. After these eliminations three lists were obtained which consisted of 61 Class I railroads, 63 department store companies, and 34 cement producers. The complete list of companies found suitable for study and the list of companies excluded, with the reasons therefor, can be found in Appendix A.

The samples selected for study are to a certain extent heterogeneous. Within each sample the companies differ in size, market served, stability, earning power, and a number of other things, some of which will probably occur to the reader. While this is true, the problem of data, as was pointed out earlier, is one of degree, and while the data are heterogeneous, it is felt that they are nevertheless sufficiently homogeneous to be of service. The reader should also be reminded that, in considering heterogeneity, the really important question is whether a particular heterogeneous factor will lead to a large systematic bias, or whether it will simply cause instead a wide random variation. If a particular heterogeneous factor appears to concentrate in a particular location of the scale, and thereby unduly influence the regression line, an adjustment to the data should be made. In the case of the samples at hand, the data were given special treatment where it appeared that heterogeneous factors might possibly distort the relationships.

On the more favorable side of the data, each sample is relatively homogeneous with respect to product. In addition, each sample provides a good distribution of observations over the important ranges of capital structure, and this is one of the reasons these particular samples were chosen. In particular, each sample has a significant number of observations with little or no debt. It will be recalled that in the case of the M & M utility sample the sparseness of observations over this range was an important criticism. The oils were not subject to this criticism, but in the case of oils there is the possibility of large error in the expected income proxy because of large variation in growth rates.

The samples selected for study here also provide a contrast between industries with different trends over time. Thus, the railroad industry had perhaps the more stable trend of the three groups during the early and middle fifties. This contrasts with the cement industry which had up to 1956 at least a fairly good growth trend. The department store companies in turn exhibited a slight downward trend from 1946 to

about 1953, at which time the situation seemed to have stabilized. The reason for the declining trend in this case was the population shift to the suburbs, which, incidentally, did benefit some of the companies which expanded into multistore operations. As might be expected, the rails and department stores exhibited relatively stable capital structures in the years preceding 1956. The cement companies exhibited somewhat more dynamic capital structures.

For each industry selected, the earnings yield-financial risk relation is studied on the two bases indicated in the preceding section. However, the only sample for which the average cost relation is studied is the railroad sample. In the case of railroads market valuations are available for about 80% of the bonds and preferreds outstanding and for about 50% of the equipment trust certificates, in addition to the 61 common stock valuations. With so many quotations available for senior securities of different quality, maturity, and coupon, there is a good basis for estimating market valuations for the closely held issues and for arriving at reliable estimates of total market values. In addition, the accounting procedures of railroads are fairly uniform so that fairly comparable average capitalization rates can be computed. In the case of the department stores and cement companies there are not a sufficient number of market quotations for debt issues to permit reliable estimation of market values for the closely held senior securities, and therefore average costs were not computed. Most of the debt issues of these companies are either term loans or private placements, and only the larger firms tended to have bonds which were traded in public markets. While the average cost of capital relation was not studied, it is not felt that this is a major limitation of the department store and cement company study. It would, of course, be desirable to have average cost data for these industries, but the yield relation and the average cost of capital relation are interrelated, empirically as well as theoretically. Accordingly, if sound inferences can be made from the yield relation, there is a basis for making inferences about the average cost of capital relation.

CHAPTER 5

Empirical Findings

5.1. Class I Railroad Study

Railroad Yields. For purposes of computing expected shareholder rate of return, the expected average future income to shareholders of Class I railroads was estimated by taking a three-year average of net earnings for common stockholders, adjusted for changes in capital structure such as conversion and retirement of preferred stock. The three years used for the average were 1954, 1955, and 1956. The years covered consist of two good business years for railroads and one poor year, and in light of the relatively stable trend of railroad revenues it is believed that the averages computed are fair approximations to future stockholder earnings. For some railroads the approximations are probably a little low while for others the approximations are probably a little high, but for reasons stated earlier it is not felt that anything but random variation will result from errors from this source when book-value debt/equity ratios are used. The market values for the equities of the railroads were computed by taking the arithmetic average of the highest and lowest quotations of the common for 1956, and by multiplying these figures by the number of common shares outstanding during 1956. Where stock splits occurred, the adjusted high-low prices before the split were also used in the calculation of average market price. The expected rates of return for the various railroads were then computed by dividing the three-year averages by the 1956 average market valuations.

With the yields thus computed, scatter diagrams were prepared and several least-squares regression lines were computed to determine

the type of relation which best describes the data and the degree of correlation present. As indicated in the preceding chapter, two debt/equity ratios were used as measures of financial risk, one with preferred stock in the denominator of the ratio and the other with preferred stock in the numerator. Class A stocks, of which there are a number in the case of railroads, were treated as preferred stock. In all of the yield tests which were conducted one very extreme observation was excluded, namely, the Missouri Pacific. The Missouri Pacific has the highest yield of all the railroads—26.96%—and also the highest debt/equity ratio—279%. When debt/equity is computed with Class A in the numerator, the ratio becomes extremely high—that is, 2841%, which is more than ten times the next highest debt/equity ratio computed on this basis.¹ This observation was excluded from the tests for two reasons. First of all, if Missouri Pacific were included, the regression lines would be completely dominated by it. If it were included in the tests, regression lines would be obtained which would tend to support the M & M hypothesized relation, but the regressions would not necessarily indicate the relationship which existed for the rest of the sample. In the second place, there is some question as to whether a debt/equity ratio of 2841% is a reasonable measure of the financial risk of the Missouri Pacific stock. The Class A stock which causes the high ratio is one of the weakest senior securities in the rail group; it is noncumulative, even when the dividend is earned but not paid, and in 1956 it received only 40% of the dividend to which it was entitled. The debt ratio with only debt in the numerator (279%) seems a more reasonable measure of the risk. However, to permit comparison of the tests using the two different measures this value was also excluded.

The scatter diagram between yield and the two risk measures for the 60 Class I railroads are presented in Figs. 5.1 and 5.2. As will be noted from the charts, the least-squares straight lines fit to the whole range of observations have positive slopes. The slope is smallest

¹ The average book-value capital structure proportions of Missouri Pacific in 1956 were as follows:

Long-Term Debt	73.6%
Class A Stock	23.0%
Class B Equity	3.4%
	100.0%

when risk is measured by debt/total equity. In this case the correlation coefficient for the whole range is $+0.173$, which is not significantly different from zero correlation.¹ When risk is measured by senior securities/common equity, the correlation coefficient is $+0.293$, which is significant at the 5% level but not at the 2% level. These two correlation coefficients contrast with the coefficients obtained by M & M in their yield tests with oils and utilities; using market-value debt ratios they obtained coefficients which ran slightly over $+0.500$ for both tests.

In addition to the straight line tests, second-degree curves were fit to the data of Figs. 5.1 and 5.2. In each case the curves obtained, when plotted, were almost identical with the straight line curves, so that no improvement in either description or coefficient resulted from the inclusion of the squared terms for the risk measures.

A third simple regression test conducted with the yield data consisted of fitting straight lines to only those observations which have

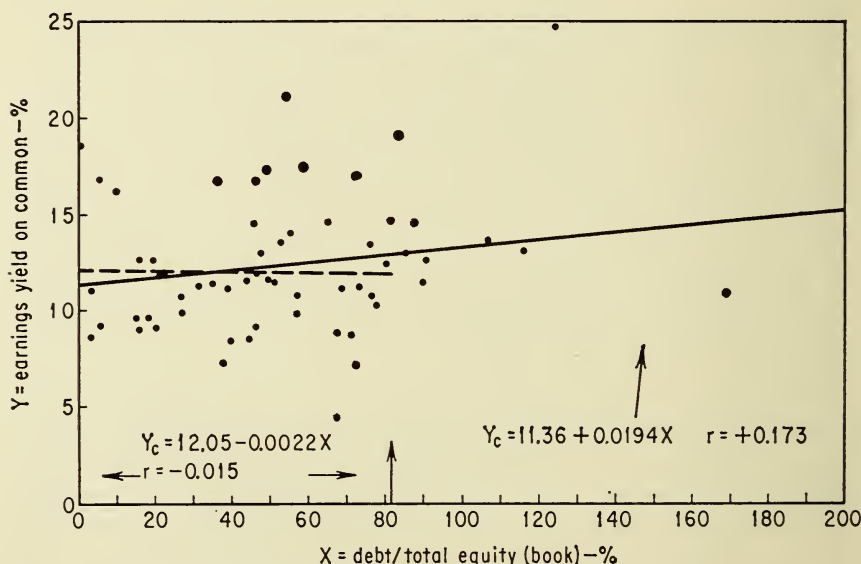


Fig. 5.1. The relationship between earnings yield on common and the ratio of debt to equity, 60 Class I railroads, 1956.

¹ Statements of statistical significance of correlation coefficients computed from straight lines are based on Table V-A of R. A. Fisher, *Statistical Methods for Research Workers*, as reproduced in Samuel B. Richmond, *Principles of Statistical Analysis* (New York: The Ronald Press, 1957), p. 459.

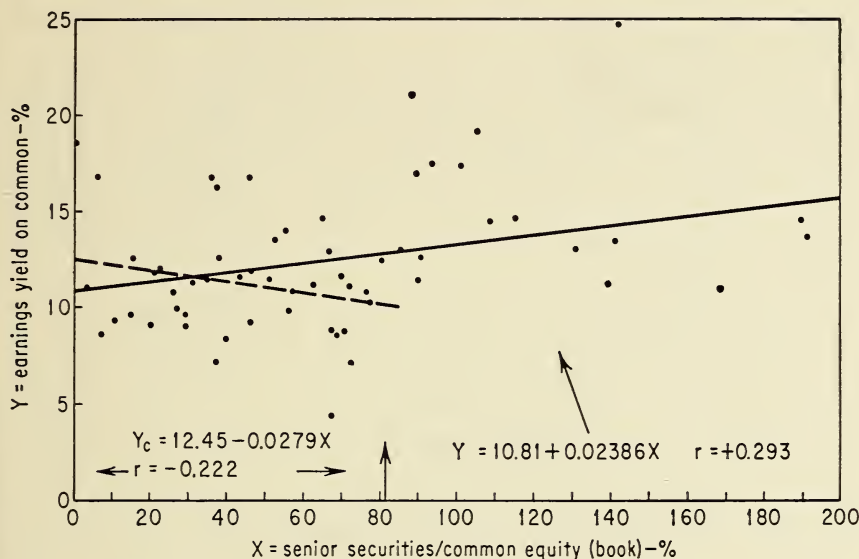


Fig. 5.2. The relationship between earnings yield on common and the ratio of debt plus preferred to common equity, 60 Class I railroads, 1956.

debt/equity or senior security ratios up to 82%. This ratio corresponds to a debt/total capital ratio of 45% and might be regarded as a maximum limit for moderate leverage. This limit has been indicated on the X-scale of the two charts. The number of observations which fall within this limit is still substantial, and when straight lines were fit the coefficients which were obtained were $-.015$ for the data of Fig. 5.1 and $-.222$ for the data of Fig. 5.2. Neither of these coefficients is significant at 5%, and the first one is very close to zero correlation. The second coefficient reflects the influence of one very low-yielding rail with a ratio of 67% (Central of New Jersey). Inspection of the scatter diagram suggests that if this observation were excluded the degree of correlation up to 82% would be closer to zero (Fig. 5.2).

The results of the three foregoing simple correlation tests are inconclusive. On the one hand, the straight-line fit over the entire range of the senior-security/common equity scale is positive in slope, and while the degree of correlation is not very great, the relation is not inconsistent with the M & M propositions. On the other hand, a straight-line fit to only those observations with ratios less than 82% tends to support a hypothesis of independence up to a moderate debt

range. Yet, second-degree curves fit to the data are almost identical to the straight-line curve.

Careful examination of the individual observations on the scatter diagram suggested that the relation between yield and senior securities/common equity might perhaps be distorted by two uncontrolled variables, and that the picture might be improved by holding these variables constant through multiple correlation technique. These two variables are eligibility for institutional investment and control by another rail.

The concept of institutional eligibility is somewhat vague, and it is difficult to characterize a stock as either eligible for institutional investment or not eligible. The reason for this is that in some states certain stocks are eligible for institutional investment, while in other states other stocks are eligible. Eligibility also probably varies within a state with the different lists in the state. Thus, a common stock eligible for savings bank and insurance company investment might not be eligible for trust account investment. What this adds up to is that institutional eligibility is a matter of degree. However, there is probably some degree of uniformity in the various lists in existence and in this study of railroad yields, institutional eligibility has been taken, for simplicity, as a quality. The determination as to whether a particular rail stock had this quality in 1956 was based on whether or not the stock appeared on the eligibility list for New York savings bank investment. The Pennsylvania list differs somewhat from the New York list but the New York list was chosen as the basis for determination, first, because New York savings banks are an important source of investment funds and, second, because to some extent the New York list serves as a standard for others.

Of the 61 railroad common stocks in the sample, 21 were found to be eligible for New York savings bank investment, and there appeared to be a definite tendency for these stocks to have low yields—and to some extent abnormally low yields. The simple scatter diagram between yield and eligibility is presented in Fig. 5.3. Many of the stocks eligible for investment are probably the stocks which savings banks would purchase in the absence of the list—that is, in free markets. Thus, such rails as the Atchison, Norfolk and Western, and the Union Pacific, all of which appear on the list, are solid financially, have stable dividend policies, and have above average future prospects. Yet while this is true there are a number of rail stocks on the list which are not as good in quality as other rails not on the list, but which still have substantially lower yields than the noneligible

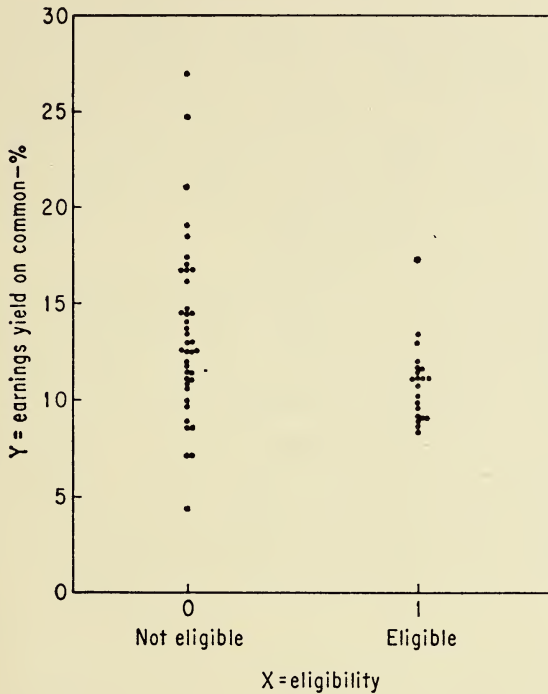


Fig. 5.3. The relationship between earnings yield on common and eligibility, 61 Class I railroads, 1956.

rails. Thus, the eligible stocks seem to have on the average a lower yield just because of their institutional eligibility.

The lower yields which arise solely because of eligibility might be thought of as a "superpremium." The term "superpremium" is a term which was coined by Professor Durand in an early article on the cost of debt and equity funds,¹ and was used by him to describe a situation in which good quality bonds sold at yield levels which were lower than those justified by risks, and which arise because of the pressure of institutional money seeking good investment and the limitations on the activities of institutional investors. In other words, superpremiums arise because of market restrictions. Professor Durand did not extend this idea of superpremium to stocks on eli-

¹ David Durand, "Costs of Debt and Equity Funds for Business: Trends and Problems of Measurement," *Conference on Research in Business Finance* (National Bureau of Economic Research, 1952), p. 231-33.

gibility lists, but the presence of such stocks and lists could have important implications for the empirical testing of hypothesized yield relations in perfect markets. Thus, if by chance only the better quality stocks and the stocks of companies with low debt/equity ratios appeared on eligibility lists, it is possible that the yield relationship which is observed in any sample might be different from the one which would exist in a perfect and free market. Figure 5.1 has been prepared to illustrate this possibility.

Figure 5.4 presents a hypothetical scatter diagram in which curve A is assumed to represent the yield/risk relationship which exists in a perfect market. However, because certain stocks are eligible for institutional investment and carry a superpremium (those marked X) the observed relationship could appear as curve B. It is not intended to suggest that the result pictured in Fig. 5.4 will actually exist in any given sample, but rather to suggest that this possibility should be considered in dealing with observed yield relations. In the case of the railroad sample the possibility is there, as there are a number of eligible stocks at the lower end of the debt scale.

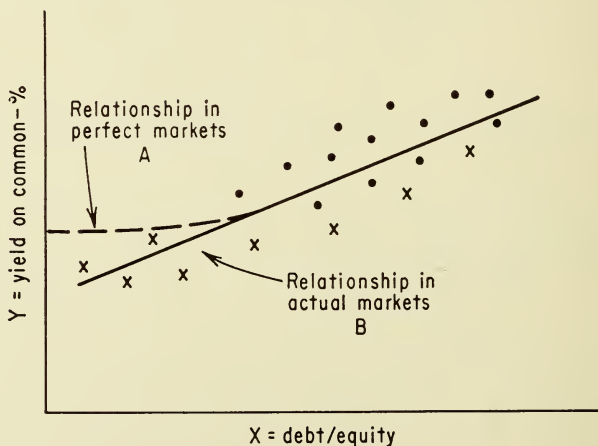


Figure 5.4

The second variable which appears to somewhat distort the yield relationship is control. There are 15 Class I railroads in the rail sample of 61 which are controlled by another rail in the sample, and one controlled by an industrial corporation, and on the average these controlled rails seem to have lower yields than the noncontrolled rails. This can be seen from Fig. 5.5, which presents the scatter diagram

between yield and control. Most of the controlled rails are small in size (less than \$50 million revenues), but there are two large ones which, in 1956, had revenues in excess of \$100 million (the Wabash and the Chicago, Burlington and Quincy).¹

There are two possible explanations for the relatively lower yields of controlled rails. First of all it is possible that control creates a thin market for the shares of the controlled rails, with the result that share prices are kept at relatively high levels. A second possible explanation is that investors may view the risks differently for such rails than for similar noncontrolled rails. Thus, investors may feel that the parent can render aid to the controlled rail in the event of financial difficulty, and for this reason may feel that the risks are somewhat less than for comparable noncontrolled rails. This explanation seems plausible for the smaller rails, but there is some question

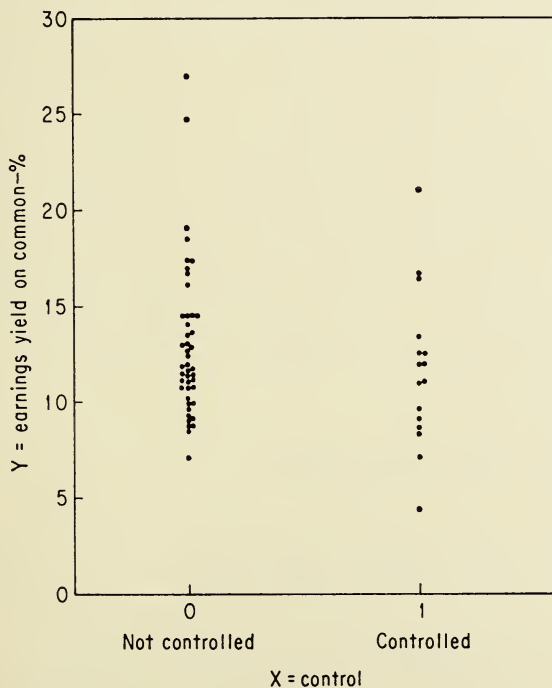


Fig. 5.5. The relationship between earnings yield on common and control, 61 Class I railroads, 1956.

¹ A list of controlled rails and their parents, with percentage ownership, can be found in Appendix A.

as to whether it would be satisfactory for the two large controlled rails. The Chicago Burlington road, which is 97% owned by the Great Northern and Northern Pacific roads, has a yield of 8.39%. Such a low yield could be justified by the quality of the stock itself in the absence of control. In contrast, the Wabash, which is 99% owned by the Pennsylvania Railroad, has a very high yield of 21%. The Wabash is not as large as the Burlington, but it is still large and has revenues in excess of \$100 million. Now if the Wabash encountered financial difficulties it is questionable whether much aid would be forthcoming from the Pennsy, first, because the amount involved would be much larger than required for a smaller rail requiring aid and, second, because the Pennsy itself is not a very strong road. Indeed, it is possible that the high yield on the Wabash stock reflects investors' views that the ownership by Pennsy increases the risks of the Wabash stock. This is just speculation, of course, but the point is that, except for the large roads, there are plausible reasons for expecting controlled rails to have lower yields than comparable noncontrolled rails. Now two of the smaller controlled rails with low yields lie on the high end of the senior securities/common equity scale (Central of Georgia and the Wisconsin Central). Inasmuch as there are not too many observations at that end of the scale, therefore, it is possible that the yield relation has been distorted by the presence of these two rails.

Because of possible distortions in the yield relation due to eligibility and control, it was decided to include these two variables in two multiple correlation equations with the debt ratio. The two equations which were fit to the 60 observations are as follows:

Equation I

$$X_1 = b_1 + b_2X_2 + b_3X_3 + b_4X_4$$

Equation II

$$X_1 = b_1 + b_2X_2 + c_2X_2^2 + b_3X_3 + b_4X_4$$

where:

X_1 = earnings yield on common (%).

X_2 = senior securities/common equity-book values (%).

X_3 = control (control = 1; noncontrol = 0).

X_4 = institutional eligibility (eligible = 1; noneligible = 0).

It will be noted that the only difference between Eq. I and Eq. II is the squared term for the debt/equity ratio. The use of this term in

Eq. II permits comparison to determine whether the curvilinear yield-risk relation—i.e., the relation which has been used to describe traditional views—is significantly better than the linear relation.

The results that were obtained when Eq. I was fit to the 60 railroads are as follows:

$$X_1 = 12.19 + .0181X_2 - .933X_3 - 2.159X_4$$

$$R_{1.234} = .411$$

The first thing to note in examining the above equation is that the use of the two additional independent variables resulted in a substantial increase in the amount of explained variation, as indicated by the coefficient of multiple correlation. The equation also shows that the average effect of control is to reduce yield by .93%. The partial correlation coefficient for X_3 , however, is only $-.120$, which is not significantly different from zero. This result occurs, in part, because of the inclusion of the Wabash in the equation with a value of 1. Thus, the correction in the controlled observations at the higher end of the X_2 scale was not too great. In contrast, the equation shows that the average effect of eligibility is to reduce yield by 2.16%. The partial correlation coefficient for eligibility is $-.293$, which is significant at 5% and almost significant at 2%. In this connection it should be noted that the average reduction shown in the equation for eligibility might very possibly reflect the influence of other variables not considered, such as dividend stability, growth rate, etc. In other words, the eligible stocks might be superior in these respects to the noneligible rails, and might command lower yields for this reason. Nevertheless, there is reason to believe that some "superpremium" exists for the eligible stocks, and since what is desired here is only an approximate adjustment for the effect of eligibility on the yield-risk relation the procedure followed is not too objectionable. When both control and eligibility are included in the regression equation, the effect is to reduce the net regression between yield and risk to $+.018$ from $+.024$, which existed in the simple regression. The partial coefficient for the risk variable is $+.226$, which is down from the $+.293$ on the simple basis. This partial coefficient, however, is subject to error because of possible overcorrection for the superpremium.

The results obtained when Eq. II was fit to the 60 observations are as follows:

$$X_1 = 12.30 + .0124X_2 + .000046X_2^2 - 1.021X_3 - 2.145X_4$$

$$X_{1.234} = .423 \quad (\text{Index of multiple correlation})$$

As will be noted the use of the squared term for the debt ratio had very little effect on the amount of explained variation. The net regression coefficients for control and eligibility are almost identical with those obtained in Eq. I above. The net regression curve for risk is almost identical with the straight line regression in Eq. I, which is what happened earlier in the simple regressions.

It is possible that the net regression between railroad yield and risk is curvilinear, but on the basis of the tests made herein this is not apparent. The positive linear relationship over the entire range seems to fit the data best, and this is not inconsistent with the M & M hypothesized relationship. However, the approximately horizontal relationship up to the 82% debt ratio suggests something else. Thus, the results of these railroad yield tests are inconclusive. It is possible that the true nature of the risk relationship could be determined from a further analysis of the relevant variables. However, this is not done here, as the basic test is the average cost test presented in the next section, and this test is more revealing.

Railroad Average Costs. The calculation of railroad average cost for purposes of testing the hypothesis of independence between average cost and capital structure consisted of two basic steps. The first step was the estimation of the expected average future income before interest for each rail in the sample. This future income was estimated, as in the case of the railroad yields, by taking an average of the years 1954, 1955, and 1956. The items included in the average were long-term debt interest, debt discount, and net income (before funds), and were obtained from the rail reports filed with the ICC. As in the case of shareholder future income, this approximation to total future income is probably low for some rails and probably high for others, but for reasons stated earlier there is no reason to expect a systematic bias to result when book-value ratios are used as the independent variable.

The second step in the calculation of average cost was the calculation of the average total market value of each rail in 1956, and this was by far the more laborious. For this calculation the first step consisted of listing each railroad long-term debt obligation (bonds and equipment trust certificates) which was outstanding in 1956. From the year-end balance sheets of 1955 and 1956 the average amount outstanding of each issue was then calculated. For those issues which had market quotations in 1956—and these constituted the majority in both number and amount—the arithmetic average of the high and low prices were calculated. The average book amount outstanding was then

multiplied by the average market price to arrive at the average market value for each debt obligation in 1956. For those instruments which did not have market quotations, average market prices were estimated on the basis of the other prices, taking into account coupon, maturity, and quality. The average amounts outstanding were then multiplied by the estimated market prices. The average market value of each rail's debt was then added to the average market value of the rail's preferred and common stock, which was obtained by multiplying average per-share prices by the number of shares outstanding during 1956. This summation gave the average total market value of each rail during 1956. The division of the expected average future income before interest by the average total market value then gave an estimate of the average market rate of capitalization of the rail income in 1956.

The measure of financial structure used to test the hypothesis of independence between average cost and financial structure is the ratio of long-term debt to total permanent capital, at book values. In the calculation of this ratio preferred stock and Class A stock were excluded from the numerator and included in the denominator. This procedure was followed because of the possibility that debt (including equipment obligations) and preferred stock have different costs. If in fact they do have different costs, then inclusion of preferred in the numerator would create an error along the X -scale and thereby bias the test. The use of only debt in the numerator of the ratio tends to keep the senior capital and the debt ratios more homogeneous. In this connection it should be noted that the measure of financial structure used in this test is a matter of indifference as far as the independence hypothesis is concerned. The reason for this is that the average cost line should be horizontal no matter what measure or X -scale is used. If in fact average cost and capital structure are independent, then the average cost line should be horizontal with the book-value ratios used here.

The scatter diagram between average cost and financial structure for the 61 Class I railroads is presented in Fig. 5.6. As can be seen, the data suggest that rail average cost does decline as debt is used. A least-squares second-degree curve fit to the data produced an index of correlation of .665; the constants obtained for the equation can be seen in the figure. To determine the significance of the reduction in squared deviations resulting from this equation a variance test was conducted. The F -ratio obtained was significant at 1% and exceeded the critical F value by a large amount. This can be seen from the Analysis of Variance Table presented in Appendix C. The value for

p_k , the rate of capitalization for the debt-free rail, is 12.39%. This value is perhaps somewhat high because of the presence of one very high observation with zero debt. Nevertheless, if one were to hypothesize a p_k of 10% for the debt-free rail of average conditions, the majority of observations would still fall below, indicating dependence between average cost and capital structure.

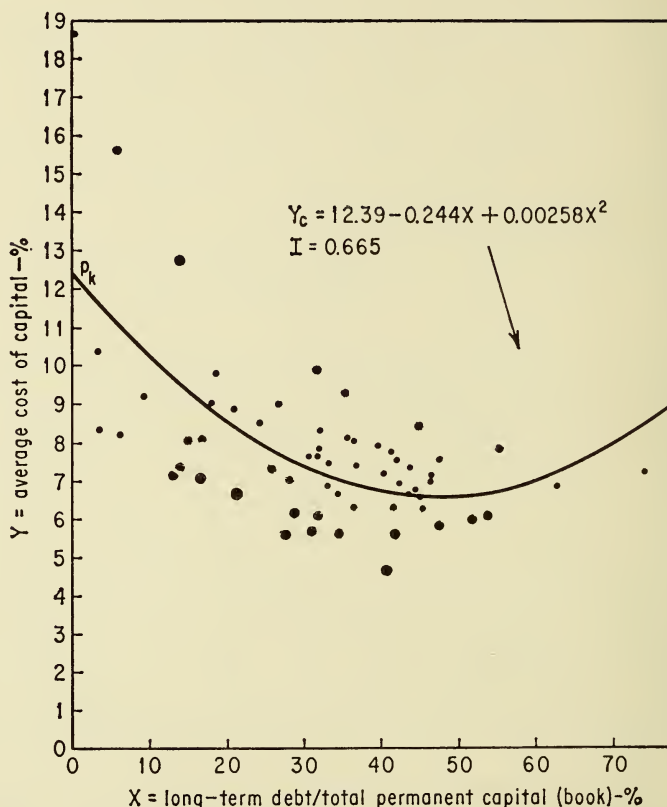


Fig. 5.6. The relationship between average cost of capital and financial structure, 61 Class I railroads, 1956.

The nature of the scatter in Fig. 5.6 presents an interesting contrast to the scatter which exists in the yield charts, and is worth discussing here because of the insight it gives on the factors affecting average cost. As a starting point it will be noted that, after making an allowance for the expanded Y-scale in Fig. 5.6, the variation in average costs for debt ratios between 30% and 60% is substantially less than the varia-

tion which exists in yields for the corresponding amounts of debt. Moving down the *X*-scale from the debt ratio of 40% it will also be noted that the scatter gradually increases, until for the small debt ratios the scatter becomes greatest. A little reflection will indicate that this peculiar variation in railroad average costs is not a chance phenomenon. To see this it should first be noted that the debt/equity ratio which corresponds to a debt/capital ratio of 40% is 67%. From the yield-debt/equity charts it is found that the yields for rails with debt/equity ratios of 67% run between 10% and 15%. Now very few railroads will earn between 10% to 15% profit for their owners over a three-year period; the average rate earned for owners probably runs between 5% and 8%. With low profitability and high market rates of capitalization, therefore, the rail stocks sell at substantial discounts from their book values. What this means is that the market value of the common, as a percentage of the total market value of all securities, is much less than the corresponding book percentage. Now, the average cost of capital, as computed, is a weighted average of the bond and stock yield. When the average cost ratio is computed for a rail with low profitability and high market yield, the average cost will not reflect the high yield of the common to a very great extent. That is, while the market yield on the common is high, the weight which this high yield will command in the weighted average will be relatively small, because the stock sells at a large discount from book value and because the market value of the common as a percentage of the total market value is relatively small. The average cost in this case will be heavily weighted by the low yield of the equipment trust obligations and the bonds, which in 1956 ran between 3.50-3.75% and 4.5-6.0%, respectively, for rails with debt ratios of about 40%. This influence of the relative weighting can be seen most clearly in the case of the Missouri Pacific, which is the highest value on the *X*-scale in the chart. The common in this case yields almost 27%, but because the market value of the common is such a small percentage of the total market value, the average cost of 7.25% which appears reflects almost entirely the weighted average of the lower-yielding equipment obligations, bonds, and Class A stock.

Because of the relatively greater weight of the debt, therefore, the average costs for rails with debt of 40% or more will not show as much variation as the yields of the commons. Moving down the scale from 40%, however, the variation in average costs increases. This is not unexpected, for as the debt ratio approaches zero the yields on the common and the average costs approach equality, until at zero debt

they are the same. Inasmuch as there was substantial variation in the common yields, the variation in average costs should increase as the average costs approach the common yields. Now this peculiar variation in average costs has important implications for the analysis of the factors influencing average cost. Factors which affect stock yields—such as size, eligibility superpremium, control, business risk, dividend stability, etc.—will also affect the average cost of capital. However, the effect of these variables which affect average cost through stock yields *will vary* with the level of debt employed by the firm. This is significant, for it means that the variables affecting average cost cannot be adequately studied, and adjusted for, through standard multiple correlation technique. The appropriate method of analysis in this case would be joint correlation technique.¹

Because of the existence of joint correlation between the dependent and independent variables, and because of the limited number of observations available for a joint correlation analysis, it was decided to break the railroad sample into five relatively homogeneous subsamples and to study the average cost relation in these subsamples. This procedure reduces the number of degrees of freedom available, but it has the advantage of reducing the variation and of placing several of the observations—and in particular, the high-value observation with no debt—in proper perspective. The subsamples were selected in such a way that one important independent variable was held constant, or approximately constant. The five subsamples selected in this way consist of 25 small Class I railroads (revenues less than \$50 million), 16 controlled railroads, 47 listed railroads, 21 eligible railroads, and 36 large railroads (revenues in excess of \$50 million). Except for the large-rail sample, which requires special treatment, least-squares curves were fit to each subsample and significance tests were made.

The scatter diagrams for average cost and capital structure for the five subsamples are presented in Figures 5.7 to 5.11. Except for the large-rail scatter diagram, each figure contains a regression equation, a coefficient indicating the degree of correlation, and a significance criterion. Looking first at the small-rail chart (Fig. 5.7), it will be noted that the index of correlation (I) obtained from the second-degree curve is .716. An analysis of variance similar to the one conducted for all 61 rails produced an F -ratio of 11.60, which is well above

¹ This method is explained and described in Ezekiel and Fox, *Methods of Correlation and Regression Analysis* (New York: John Wiley & Sons, 1959), pp. 273-74 and 348-77.

the 1% significance ratio of 5.72. This is indicated in the figure. In contrast to the small-rail subsample, the controlled-rail sample shows an index of correlation of .616, or 14% less. However, because of the smaller number of degrees of freedom in this sample, the F -ratio obtained is 3.94, and this is significant at only 5% (Fig. 5.8).

The figure for the listed rails (5.9) contains two regression equations and significance ratios. The equation at the top of the figure is the equation which was obtained when the curve was fit to all 47 of the observations. As will be noted, the index of correlation obtained is .508, and the F -ratio obtained is 7.66, which is above the 1% significance criterion. The equation at the bottom of the figure was ob-

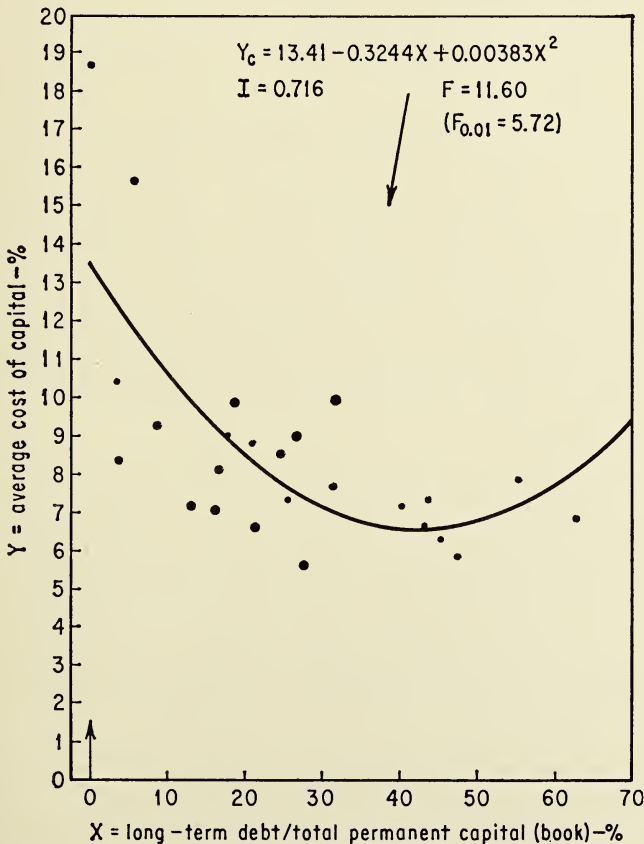


Fig. 5.7. The relationship between average cost of capital and financial structure, 25 small Class I railroads (less than \$50 million revenues), 1956.

tained from only 46 of the observations. The observation which was excluded was the highest-average cost observation in the figure, which appears at the lower end of the debt scale. As will be noted, the elimination of this high-value observation reduced the F -ratio to just a shade over the 1% significance level. Thus, the significance of the first test does not depend on the one high-value observation.

The 21 eligible rails did not evidence a clear-cut U-shaped average cost curve, so only the linear equation was fit to the data. The

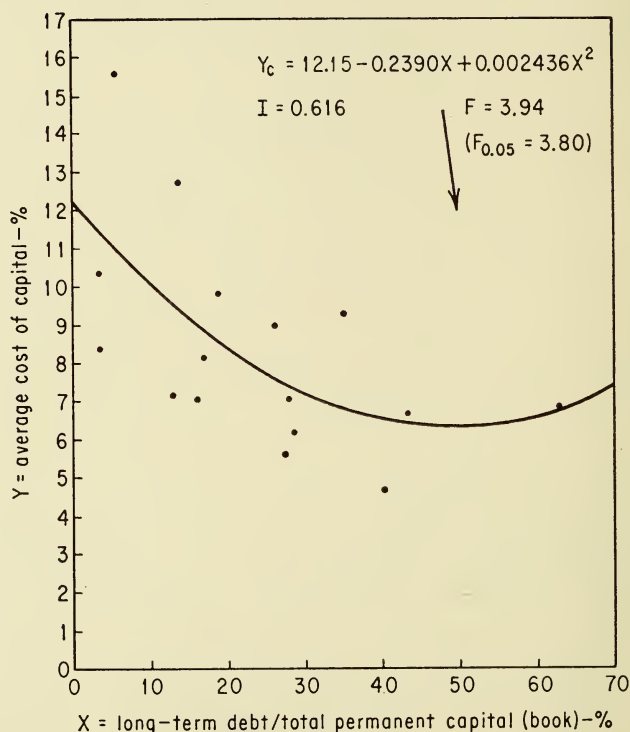


Fig. 5.8. The relationship between average cost of capital and financial structure, 16 controlled Class I railroads, 1956.

coefficient of correlation obtained here, however, is quite large, and exceeds the 1% significance criterion by a large amount (Fig. 5.10). Thus, this subsample, along with the three preceding ones, tends to discredit a hypothesis of independence.

The scatter diagram for the large-rail sample is presented in Fig. 5.11, and as will be noted no curve was fit to the data. A curve was

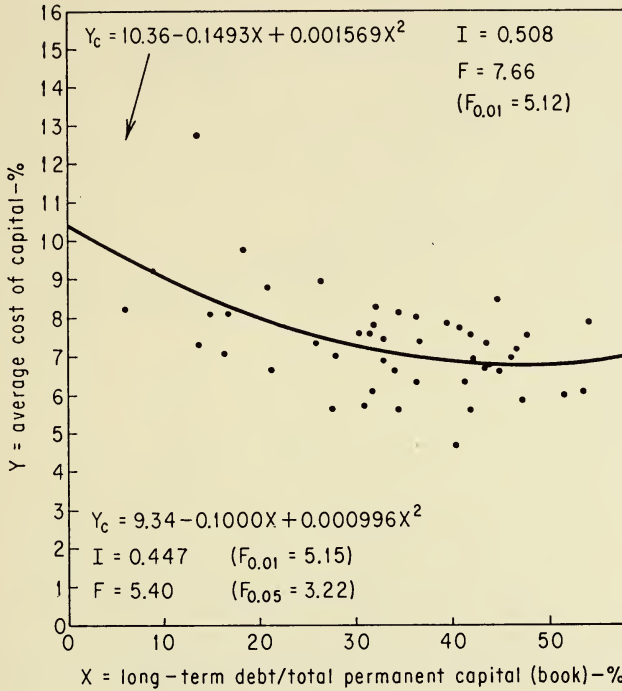


Fig. 5.9. The relationship between average cost of capital and financial structure, 47 listed Class I railroads (listed on New York or American Stock Exchange), 1956.

not fit in this case as no statistical significance would attach to it. Yet while this sample has no statistical significance, it is perhaps one of the most significant samples studied so far. This may seem strange in view of the fact that there are only four observations at the lower end of the debt scale. Nevertheless, the statement seems justified after a careful examination of these observations and a comparison of them with the other rails toward the center of the X-scale.

The four observations in the large-rail subsample which have low debt ratios are the Atchison, the Norfolk and Western, the Union Pacific, and the St. Louis-Southwestern, and this has been indicated in Fig. 5.11. The amount of debt employed by these rails is substantially less than the amount employed by the other 32 large rails, and this can be seen by noting the large gap between the two sets of observations in the chart. Thus, for practical purposes the question of the measure of capital structure is not a problem; these rails all

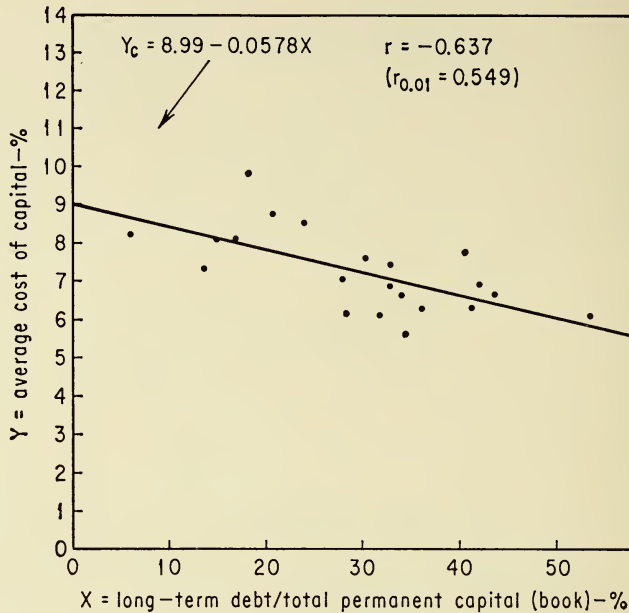


Fig. 5.10. The relationship between average cost of capital and financial structure, 21 eligible Class I railroads (stock eligible for New York Savings Bank Investment), 1956.

use substantially less debt. The St. Louis-Southwestern is one of the smallest rails in the subsample of the 36 large rails and is also the most unstable of all, and this probably accounts in part for its high average cost.¹ In any event, this high observation is not inconsistent with a declining average cost curve and a hypothesis of dependence. The other three observations, however, are more questionable, and it will therefore be more useful to focus attention on these.

The average cost of capital for the Atchison, the Norfolk and Western, and the Union Pacific is 7.88%. The average cost of capital for the 32 large rails which use substantially more debt is 7.01%. Thus, the difference between the averages of the three low-debt observations and the 32 high-debt observations is 0.87%. Now at this point it is appropriate to ask: Could the difference in average value between the two groups be a sampling fluctuation, and therefore with-

¹ See the railroad data in Appendix A for the measure used to get an idea of the stability of a rail.

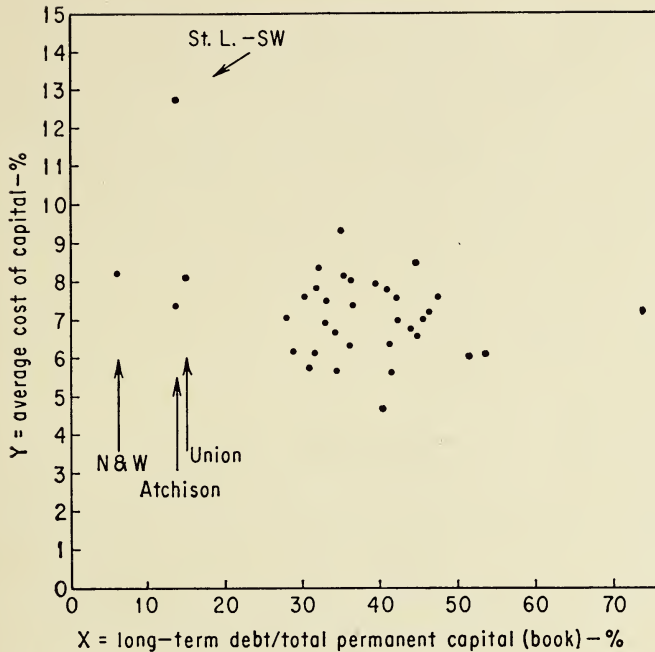


Fig. 5.11. The relationship between average cost of capital and financial structure, 36 large Class I railroads (more than \$50 million revenues), 1956.

out significance for the average cost question? Yes, it could be, but in the opinion of the writer the difference is neither a random fluctuation nor a difference without significance. Instead, it is felt that the difference reflects a real dependence between average cost and capital structure. This view can be appreciated by a consideration of certain variables which are almost certain to be exerting a downward bias on the average cost of the three low-debt rails. In other words, the three low-debt rails are not comparable with the other 32 rails, and after making allowance for the noncomparable factors there is a basis for believing that the difference between the two groups should be substantially larger than observed.

What are some of the variables which exert a downward bias on the average cost of the three low-debt large rails? There are many, and several of the more important ones will be enumerated here. First, and most important, there is a basis for believing that the expected future income proxy for all three rails is low, and that the error involved is

much larger than for the other 32 large rails. That the Atchison, Norfolk and Western, and Union Pacific have had better than average growth is well-known.¹ In 1956, the future prospects for each of the three rails was above average, and, in the case of the Atchison and Union Pacific, were enhanced by the increasing growth in oil income. In the second place, all three of the low-debt large rails are eligible for New York savings bank investment, whereas only 14, or 44%, of the other 32 rails are. In addition, all three are on the Pennsylvania list, whereas only 7, or 22%, of the other 32 rails are on both lists. Furthermore, it is probable that the three low-debt rails appear on more state eligibility lists than any of the other 32 rails. Since the average costs of the three low-debt rails reflect principally the yield on the stocks, and since there is a basis for believing in the existence of "superpremium," the average cost of these three rails probably has a much greater downward bias from eligibility than the other 32 rails, on average. In the third place, two of the three rails, or 66%, had stock splits in 1956, and this probably did not hurt the market's valuation for their shares. In contrast, only 5, or 16%, of the other 32 rails had stock splits in 1956. Finally, all three rails are larger (in terms of revenues) than the average of the other 32 rails. On the assumption that business risk is to some extent related to size, the business risk of these three rails is probably less than the average of the other 32 rails, and this in turn probably accounts for part of their relatively low stock yields and average costs.

After making allowance for the noncomparables it is felt that the average cost of capital for the three low-debt large rails should be at least 1% greater than observed. The question which remains is whether the average cost of capital for the other 32 large rails is subject to any downward bias, relative to the three low-debt large rails. If there are any biases, this writer is unaware of them. Extreme care was taken in the calculation of the average costs for the levered rails, and while difficulties were encountered in two or three cases, it is felt that no serious errors exist in the calculations. Accordingly, it is felt that the large-rail subsample, in addition to the other four subsamples, casts serious doubt as to the validity of the hypothesis of independence.

In addition to the tests for the entire sample and the five subsamples, two additional tests were made to provide a contrast. The first test made is an average-cost test using market-value capital struc-

¹ Cf., *Investor's Reader: Special Issue: Railroads* (Merrill Lynch, Pierce, Fenner, and Smith, June 8, 1960).

ture ratios as the independent variable—i.e., the independent variable used by M & M. The scatter diagram between average cost and market-value capital structure is presented in Fig. 5.12. It will be noted that the index of correlation obtained is almost identical to the index obtained when book-value capital structure was used. However, important differences exist. First of all, it will be noted that most of the observations moved up on the X-scale. This occurred because most of the rail stocks are selling at large discounts from their book values, so that the senior securities on a market-value basis become greater relative to the common. Secondly, it will be noted that because of the shift in the points, the dependence of the curve on the high-cost observation with zero debt is increased. The p_k in this case is 13.38%, almost exactly 1% higher than in the other test. Consistent with what was said in Chapter 3, a biased test could support the traditional cost curve if there were observations in the sample with zero debt. This occurs here, but the curve depends to a greater extent on the one high-cost, zero-debt observation. Finally, it will be noted that

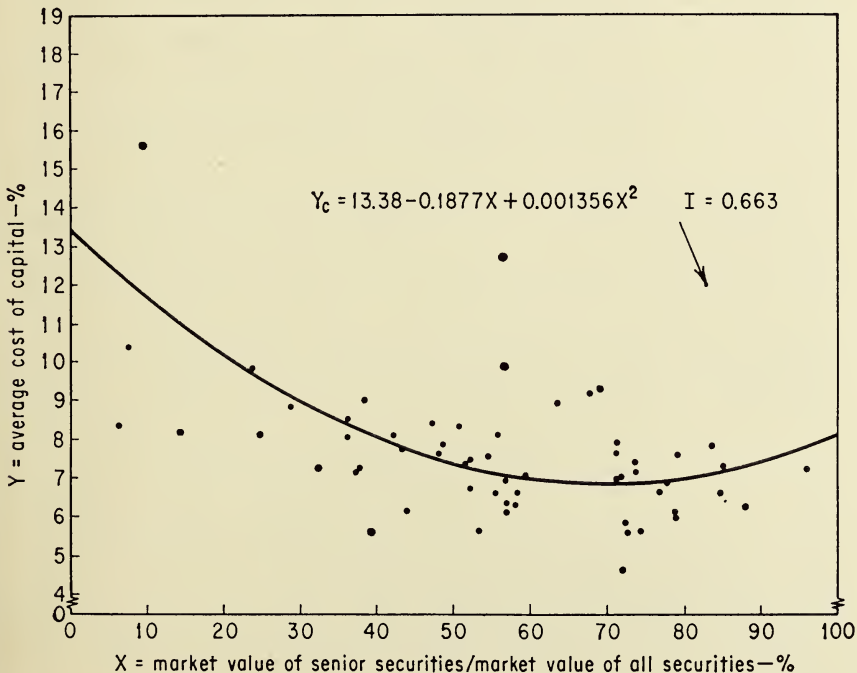


Fig. 5.12. The relationship between average cost of capital and market-value capital structure, 61 Class I railroads, 1956.

at a 100% senior-security ratio, the predicted average cost is only about 8.15%. This contrasts sharply with what the curve in Fig. 5.6 implies.

The second test made is a test of the relationship between railroad market value and the ratio of long-term debt to total permanent capital. In their paper M & M presented the results of a similar test using oils and utilities, but the results of their tests showed independence between total market value and debt usage.¹ Since the tests presented here differ in both results and method, it will be helpful to describe briefly their testing procedure, and then indicate the reasons for the procedures adopted here.

In their supplementary market-value tests M & M fit the following equation to their oil and utility data:

$$X_1 = b_1 + b_2X_2 + b_3X_3$$

where:

$X_1 = V/A$ = the market value of all securities divided by the book value of the firm.

$X_2 = D/A$ = the market value of all senior securities divided by the book value of the firm.

$X_3 = X/A$ = the estimated income of the firm (before deduction of interest) divided by the book value of the firm.

The reasoning behind the choice of the above equation and variables is as follows: If debt reduces the average market rate of capitalization of a firm's future income, then the market value of the firm should increase as debt is used. If in fact there is independence between average cost of capital and debt usage then there should be independence between total market value and debt. For purposes of testing the relationship, a number of adjustments is necessary. First of all, the market values of firms will vary because the returns of security holders vary and not necessarily because of variation in average capitalization rate. Therefore, to test for the relationship between market value and debt usage the expected income should be included in the equation to hold it constant at its average value. In addition to this, the market value of firms will differ because of variations in scale and in the size of the debt. Without any adjustment for scale the relationship would be dominated by the market value of large firms with large debt.

¹ The supplementary tests conducted by M & M are explained and described in a footnote to their paper. Cf., *op. cit.*, note 38, p. 284.

M & M therefore divided all variables in the equation by the book value of the firm to adjust for differences in scale. They do not indicate, however, what they mean by the book value of the firm; this could be the book value of the total assets or the book value of the total permanent capital.

When the equation given above was fit to the oil and utility data, M & M obtained partial correlation coefficients for the adjusted debt variable (X_2) which were not significantly different from zero, and which, in the case of utilities, had a negative sign. Now, it is possible that the problems associated with the oils and utilities are unique, and that the above test would have proved favorable to the traditional view with different samples. However, this writer feels that the above test was deficient in at least one respect, and possibly two. First of all, it is felt that the straight-line regression for the debt variable is inappropriate. Traditional finance holds that average cost turns up beyond a certain point in debt usage; alternatively, total market value should decline as debt is used beyond a certain point. Therefore, it is felt that a squared term should be included for debt in the market value test. Secondly, it is felt that the adjustment for scale should be made with the book value of the capital structure. It is not clear whether M & M use the book value of the total assets or the book value of the capital structure, as indicated above. Nevertheless, it is felt that if the book value of the total assets is used, the correlation between total market value and debt, if any, will be lower. The comparison should be, it is felt, between the market value of the capital structure and the book value of the capital structure, and not between the market value of the capital structure and the book value of the total assets.

On the basis of the foregoing reasoning it was decided to make the total market value test by fitting the following equation to the sample of 61 rails:

$$X_1 = b_1 + b_2X_2 + c_2X_2^2 + b_3X_3$$

where:

$X_1 = V/BVCS$ = the market value of all securities (the market value of the capital structure) divided by the total permanent capital (the book value of the capital structure) — %.

$X_2 = D/BVCS$ = the book value of the long-term debt divided by the book value of the total permanent capital — %.

$X_3 = \bar{X}/BVCS$ = the estimated expected future income to all security holders divided by the book value of the total permanent capital (the estimated rate of return on the book value of the capital structure) — %.

The results that were obtained when the above equation was fit are as follows:

$$X_1 = 4.87 + 1.118X_2 - .01066X_2^2 + 7.298X_3$$

$$I_{1.23} = .813 \quad (\text{Index of multiple correlation})$$

As will be noted, the index of correlation obtained is quite high (.813). In nontechnical terms, this means that the market value of the capital structure shows a good relationship with: (1) the rate of return earned on the book value of the permanent capital; and (2) the amount of debt in the capital structure. The index of partial correlation for the debt variable (X_2) is .540. An analysis of variance made to determine the significance of the reduction in squared deviations due to X_2 and X_2^2 combined produced an F -ratio of 11.76. The critical F -ratio is 5.01.

The results of the market value test can be appreciated better when the net regression between market value and debt/capital is plotted. This has been done in Fig. 5.13, which shows the following: (1) the net regression between total market value and capital structure when the rate of return earned on the total book capital has been statistically held constant at its average value; (2) the net regression equation; (3) the partial index of correlation; (4) the F -ratio obtained for the reduction in squared deviations; and (5) the 1% significance level for the F -ratio. The average rate of return earned on the book value of the permanent capital for all 61 rails—using the three-year average—is 5.07%. Thus, the Y -intercept in Fig. 5.13 may be given the following interpretation: For the debt-free rail earning the average rate of return on the book value of the capital structure (5.07%), the market value of the capital structure—in this case, the market value of the common—will be approximately 42% of the book value of the capital structure. As debt is employed up to a 50% ratio, the market value of the capital structure will increase relative to the book value of the capital structure.

5.2. Department Store Study

As indicated in the previous chapter average costs were not studied for the department store companies because of the absence of a large

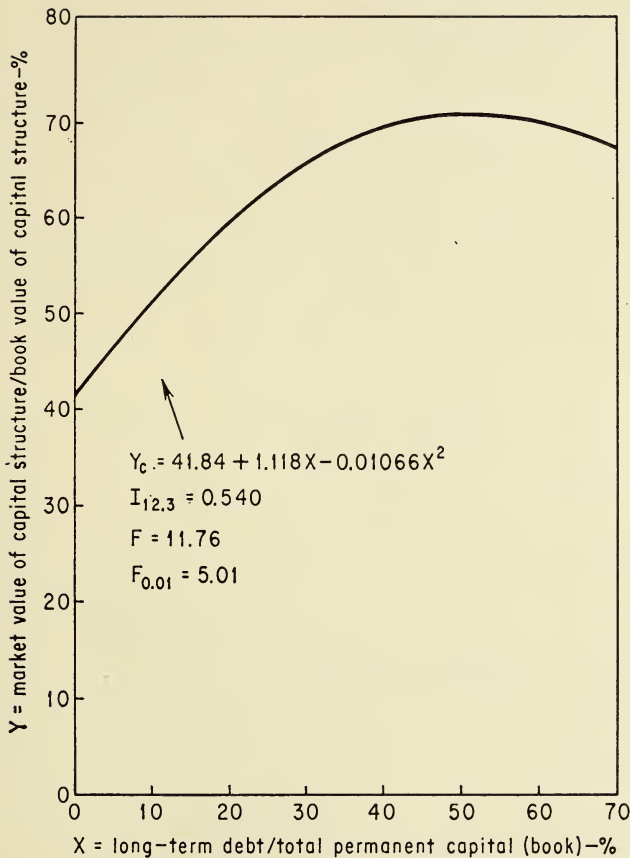


Fig. 5.13. The relationship between total market value and financial structure, 61 Class I railroads, 1956.

number of quotations for the senior securities of such companies. The yields for department store companies were computed in a somewhat simpler way than in the case of railroads. Specifically, per-share data were used, and the expected rate of return on common was estimated by taking a two-year average of per-share earnings (1955 and 1956) and dividing by the average of the high and low common prices during 1956. The only adjustments that were made before averaging the two-year per-share earnings were for stock splits, stock dividends, and large conversions of preferred stock. In only one or two cases were conversions significant, and because capital structures were very stable for the bulk of the observations it is believed that the yields computed are reasonably accurate. Financial risk was measured, as before, with

the book value debt/equity ratio computed on two bases, that is, with preferred in the denominator and with preferred in the numerator.

Figure 5.14 presents the scatter diagram obtained between yield and the ratio of debt to total equity for the 63 department stores in the sample. As will be noted, the variation in yields is quite substantial, and there is very little evidence of correlation between the two variables. The least-squares straight line fit to the data produced a coefficient of correlation of $+0.068$, which is not significantly different from zero. In this connection it is relevant to note that the conventional debt standard sometimes used for industrial companies is 35%, when the debt is computed as a percentage of the total permanent

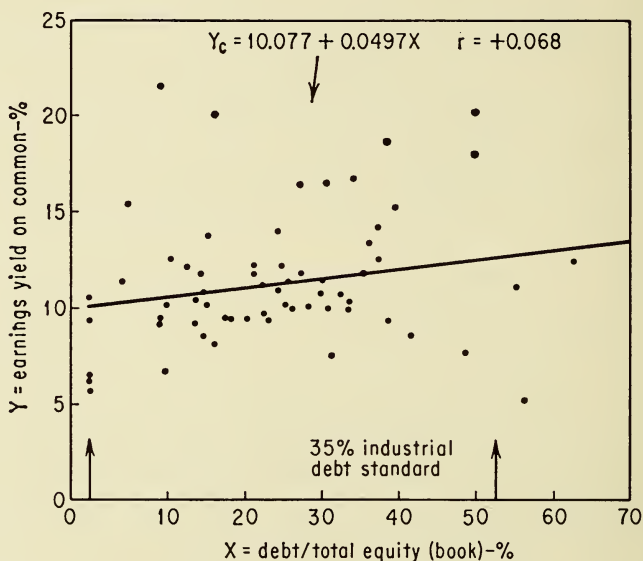


Fig. 5.14. The relationship between earnings yield on common and the ratio of debt to equity, 63 department store companies, 1956.

capital.¹ The debt/equity ratio which corresponds to this debt standard is about 52.5%, and this has been indicated on the X-scale in Fig. 5.14.

¹ Guthmann suggests a debt limit of one-third for industrial companies while Robbins suggests a debt limit of 35%. Robbins also suggests that this limit for industrials applies to bonds and preferred stock combined. Cf., Harry G. Guthmann, *Analysis of Financial Statements* (Englewood Cliffs: Prentice-Hall, Inc., 1953), p. 158. Also, Sidney M. Robbins, *Managing Securities* (Boston: Houghton Mifflin Company, 1954), p. 169.

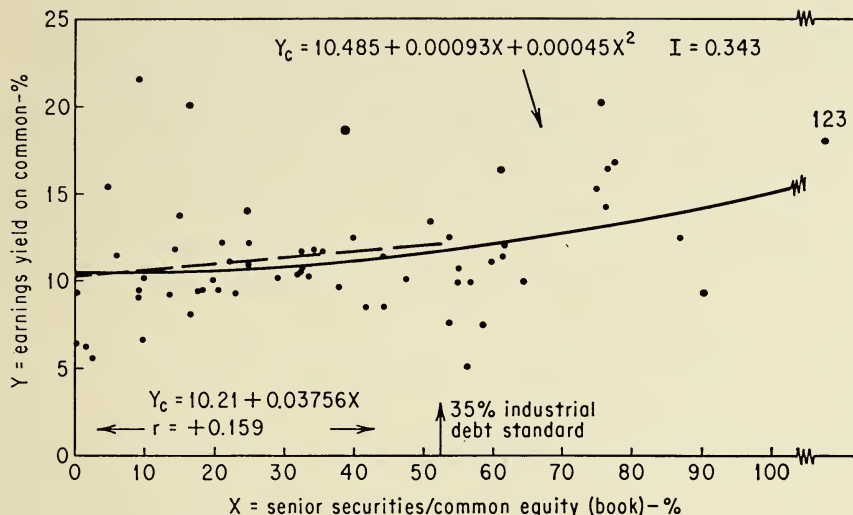


Fig. 5.15. The relationship between earnings yield on common and the ratio of debt plus preferred to common equity, 63 department store companies, 1956.

Only three observations exceed this standard, and the amount by which they do is very small. Thus, this particular test lends support to the view that the use of debt up to the conventional limit does not increase the yield of a stock significantly.

When the yield test is made using the ratio of senior securities to common equity, there is some support for the view that yields rise linearly with the debt/equity ratio. The scatter diagram between yield and debt/equity with preferred in the numerator is presented in Fig. 5.15. A least-squares straight-line fit to this data produces a coefficient of correlation of $+0.323$, which is just significant at the 1% level. A second-degree curve fit to the same data produces an index of correlation of $.343$ and a somewhat better description of the data, but the improvement is not statistically significant. When a line is fit to only the observations up to the conventional debt limit, a straight line with positive slope is obtained (dashed line in figure). The degree of correlation for this line, however, is only $+0.159$ and is not statistically significant.

The wide variation in department store yields is due in large part to the fact that the firms in the sample differ greatly in size. In Fig. 5.16 the relationship between yield and company size, as measured by sales in 1956, is presented. It will be noted that as size increases from

zero to \$50 million there is a tendency for yield to fall. From \$50 million to \$600 million the relationship is not too clear; it is either horizontal or it has some negative slope. The three observations above \$600 million are Sears, J. C. Penney, and Montgomery Ward, and all have sales above \$1 billion and yields which are decidedly lower than

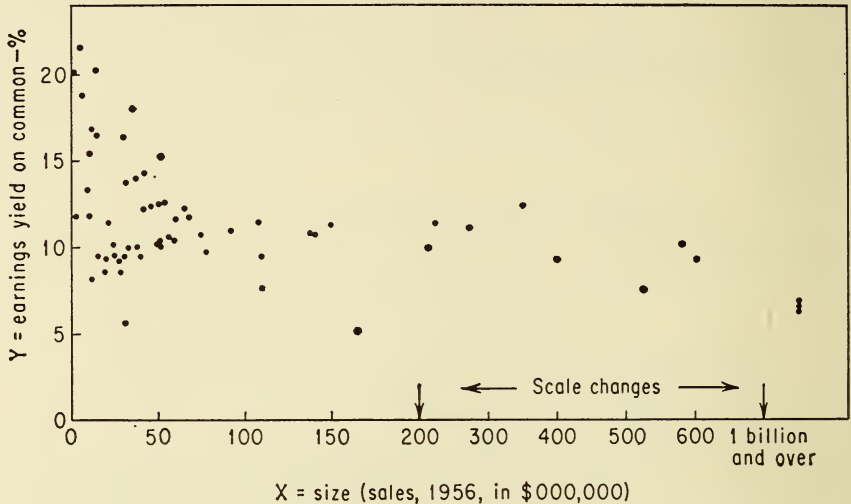


Fig. 5.16. The relationship between earnings yield on common and size, 63 department store companies, 1956.

the others. It was stated earlier that the relatively high yields of small firms can probably be explained by poor diversification (larger business risk), poor collateralability and marketability of shares, poor growth relative to larger firms, ineligibility for institutional investment, and investor preference for well-known firms. These conditions will not exist for all small firms, and there are many small firms which are attractive investments. Nevertheless, for the smaller firms as a group there is probably a good deal of variation in these factors, and such variation will probably be reflected in their yields. The large variation in the yields of department stores up to \$50 million sales testifies to this. For the large firms, however, there is likely to be greater homogeneity in these "other" influences. For the "giants" the influences are likely to be still different. Therefore, a better picture of the yield/financial risk relation can be obtained by "homogenizing" the sample somewhat. This has been done by dropping all companies

with sales below \$50 million and above \$600 million from the sample. This leaves 28 observations and a fair number of degrees of freedom.

The relationship between yield and debt to total equity for the companies with sales between \$50 and \$600 million is presented in Fig. 5.17. As will be noted there is still a good spread of observations over the important range of capital structure for the smaller sample. A least-squares straight-line fit to the data is almost horizontal and produces a coefficient of correlation of -0.035 , which is very close to zero. Thus, this homogenized sample tends to support the conclusion

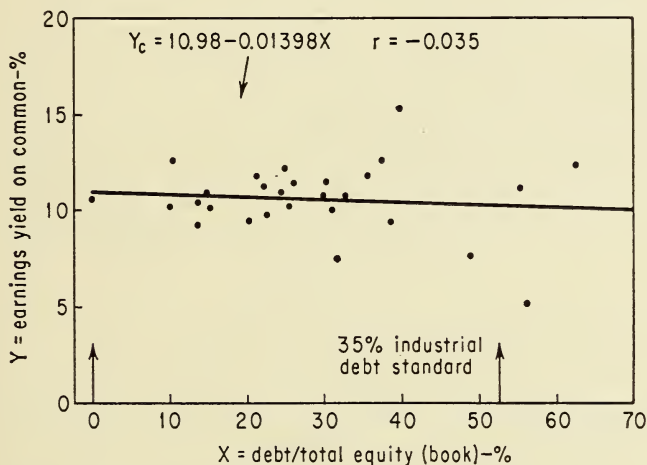


Fig. 5.17. The relationship between earnings yield on common and the ratio of debt to equity, 28 department store companies with sales between 50 and 600 million dollars, 1956.

suggested by the entire sample, namely, that the use of debt up to the conventional limit does not increase the yield on stock.

The relationship between yield and senior securities to common equity for the homogenized sample is presented in Fig. 5.18. As will be noted, the least-squares straight-line fit to the data is almost horizontal. The coefficient of correlation obtained is $+0.073$, which is not statistically significant and which is substantially lower than the $+0.323$ which was obtained for the entire sample. This homogenized sample thus suggests that the use of debt and preferred up to the conventional limit does not increase the yield on the common stock.

In addition to the foregoing book-value tests, two additional tests

have been made with the department store data using a debt/equity ratio similar to the one used by M & M in their yield tests. It will be recalled that in their tests M & M measured financial risk by the ratio of market value of senior securities to the market value of the common equity. In the tests made herein, book values have been used for the senior securities and the numerator of the ratio, while the market value of the common equity was used for the denominator. Inasmuch as book values do not differ too much from market values for senior securities—in this industry at least—the measure is approximately the same as the one used by M & M in their statistical tests.

The first test made with the approximate market-value debt ratio is a regression test between yield and the market-value ratios for the homogenized sample. The scatter diagram using these variables is presented in Fig. 5.19; this figure should be compared with Fig. 5.18, which is identical in all respects except that book values were used in the denominator of the debt/equity ratio. The first thing to note in

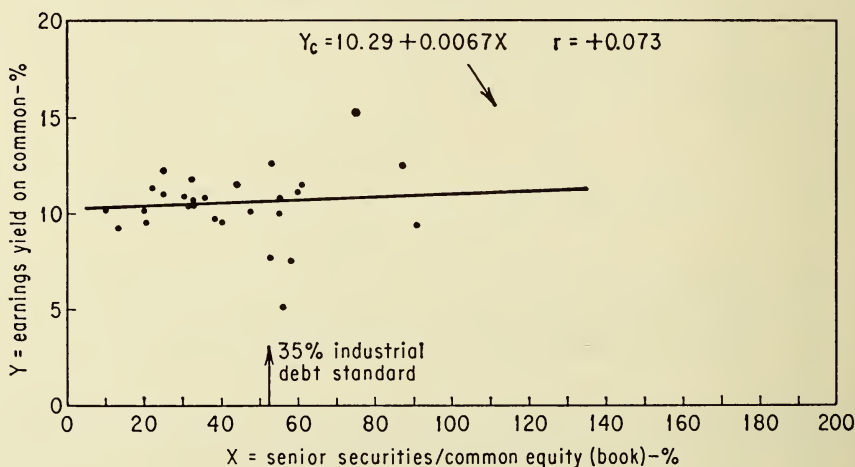


Fig. 5.18. The relationship between earnings yield on common and the ratio of debt plus preferred on common equity, 28 department store companies with sales between 50 and 600 million dollars, 1956.

examining Fig. 5.19 is that when the market-value debt ratios are used there is a tendency for most observations to shift up the X-scale. This occurs because the rates of return earned on book value for most observations are below market rates of capitalization, with the result that the common shares sell below their book values. Secondly, it will

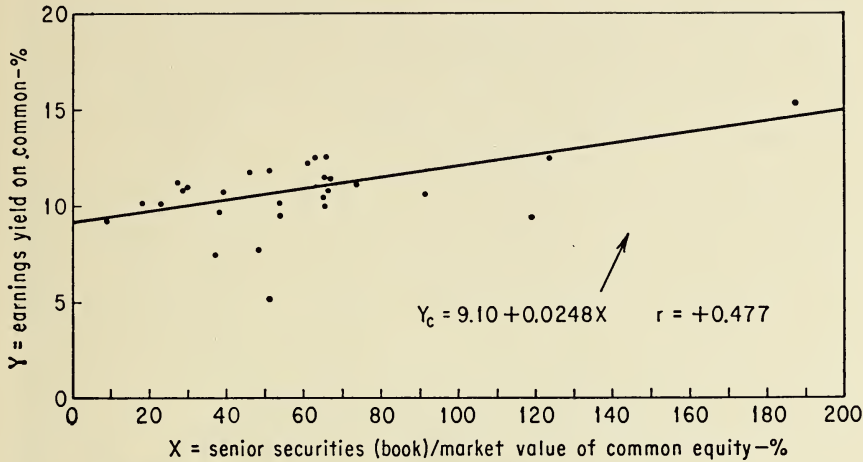


Fig. 5.19. The relationship between earnings yield on common and the ratio of debt plus preferred to market value of common stock, 28 department store companies with sales between 50 and 600 million dollars, 1956.

be noted that there is not only a shift in one direction of the scale for the observations, but that there is also a relative shift among the observations. Specifically, it will be noted that the high-yield observations moved further up the scale relative to the low-yield observations. This is significant, for it shows that even with a relatively homogeneous sample, the slight heterogeneity which exists will still cause a change in the pattern when market-value debt/equity is used as the measure of financial risk. The observation at the extreme right of the chart with the highest yield represents the second-smallest company in the homogenized sample (Halle Brothers). Two firms with low yields and substantially better than average growth actually moved down the scale (the Federated Department Stores and the May Company). A least-squares line fit to the data produced a coefficient of correlation of $+0.477$, which is just significant for this size sample, but which has questionable value in the analysis of financial risk.

The second test made is a test to indicate the extent to which variations in yields due to heterogeneous factors will offset when the market-value and book-value ratios are used in a financial-risk test. For this test the 63 department stores were split up into two groups—32 stores with sales below \$50 million and 31 stores with sales above \$50 million. The sample was split up according to sales because there

is a basis for believing that smaller firms will have higher yields than larger firms for reasons other than financial risk. If this is true, then in an unbiased test for financial risk the high yields of the smaller firms should be offset by the lower yields of the larger firms, to give a fair offsetting of the heterogeneous factors.

For each of the two department store groups the average yield was computed. For the 32 small stores this was 12.69%; for the 31 large stores the average was 10.18%, or, about 2.5% less. In addition, for each group the average senior securities/common equity ratio at book was computed. The 32 small stores showed an average book debt ratio of 35.96%; the average for the 31 large stores was 39.32%—about 3.3% higher. This would not be unexpected if one held that the amount of debt that can be safely carried depends on the degree of business risk, and that small firms are typically more risky than large firms. In any event, the difference is not very great. When the debt/equity ratio is computed using the approximate market-value measure the difference is substantial. The average market-value debt/equity ratio for the large firms is 54.1%, or 37.7% higher than the book value average. The average for the small firms is 100.9%–180.7% above the book value average. The significance of this for the correlation analysis can be appreciated by comparing the two parts of Fig. 5.20.

The very large increase in the average market-value debt ratio for the small firms is in part attributed to one small firm whose market value debt/equity ratio was very substantially above its book debt ratio (City of Paris). Without the City of Paris the average market-value debt ratio for the small firms is 63.8%–84.1% higher than the average book ratio. Two things should be noted in this connection. First of all, even without the extreme observation the relative shift in the average for small firms is substantial. Secondly, the shift in the City of Paris is significant in itself. Examination of the financial statements of this firm reveals that in 1955 and 1956 its average return on book value was very low, namely, 1.03%. This is probably the lowest rate of return in the sample. Examination of the statements also shows that City of Paris' performance in those two years was not temporary; earnings had declined steadily from a good level in the late forties. Thus, the high yield on this stock (16.43%) reflects high business risk and poor profits performance, and not necessarily high financial risk. In other words, judging from the record of the firm, the management is below average, and the business risk of the firm is above average. This can probably be said for a number of

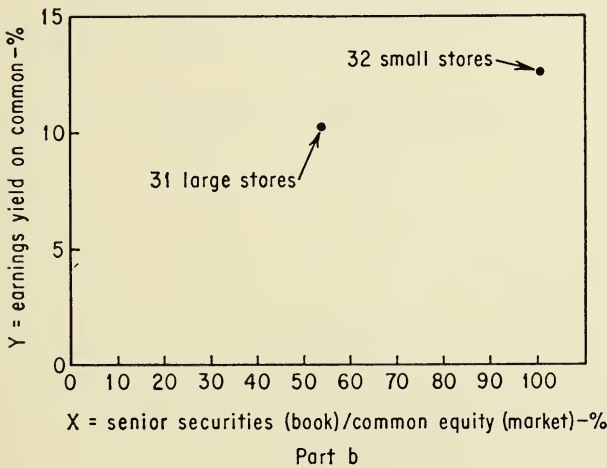
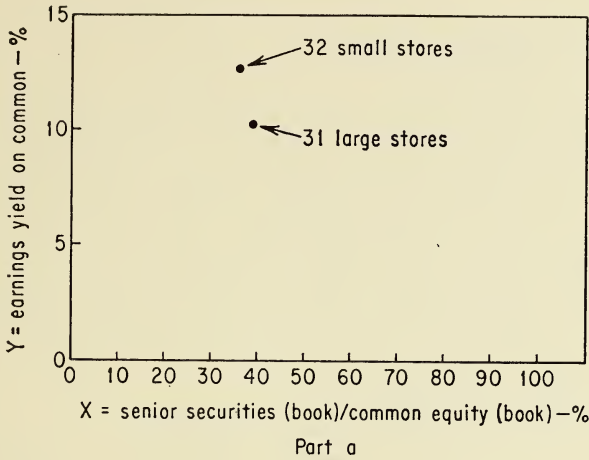


Fig. 5.20. Yield and capital structure group averages, 32 small department stores and 31 large department stores, 1956.

the other small firms also. A least-squares line fit to all of the 63 observations, using market value ratios, would produce a significant correlation coefficient and a regression line supporting the M & M propositions, but the line would not represent the relationship between yield and financial risk for a homogeneous group of firms. The variation in yields due to variation in the other variables would be systematic and not random.

5.3. Cement Industry Study

The final yield tests are conducted with the sample of cement companies. This sample is not very large but it is interesting because it is one of the few industries in which there is a large number of observations with little or no debt. In addition, except for three companies, the amount of preferred stock employed in this industry is small, so that the senior securities in the sample are relatively homogeneous from a risk-creating standpoint. The yields and debt/equity ratios for the individual companies were computed in the same way that department store yields and ratios were computed, so that no additional explanation is required.

Figure 5.21 presents the relation obtained for yield and debt to total equity for the 34 companies in the sample. As will be noted from the figure, the variation in cement yields is somewhat less than in the other two industries studied. Of special interest is the large number of observations which fall on or close to the zero debt line.

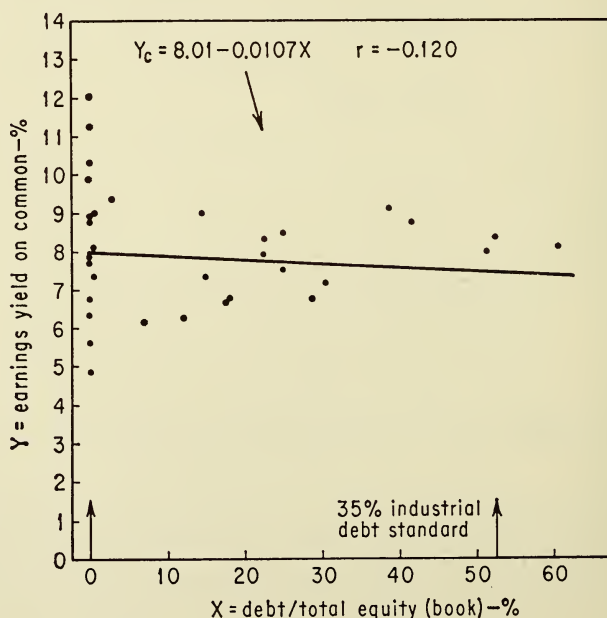


Fig. 5.21. The relationship between earnings yield on common and the ratio of debt to equity, 34 cement companies, 1956.

There does not appear to be any tendency for these observations to concentrate at the lower yields. Instead they seem to be evenly distributed around the average yield for all observations. The least-squares line has a slight negative slope and reflects the influence of one relatively low yield. The coefficient of correlation is $-.120$, which is not statistically significant from zero. Only one observation has debt in excess of the conventional debt standard of 52.5%.

When debt/equity is computed with preferred stock in the numerator, two observations appear with very high debt/equity ratios. One of the observations, which has 95% preferred stock in its capital structure, has a relatively high yield, and can be seen in Fig. 5.22.

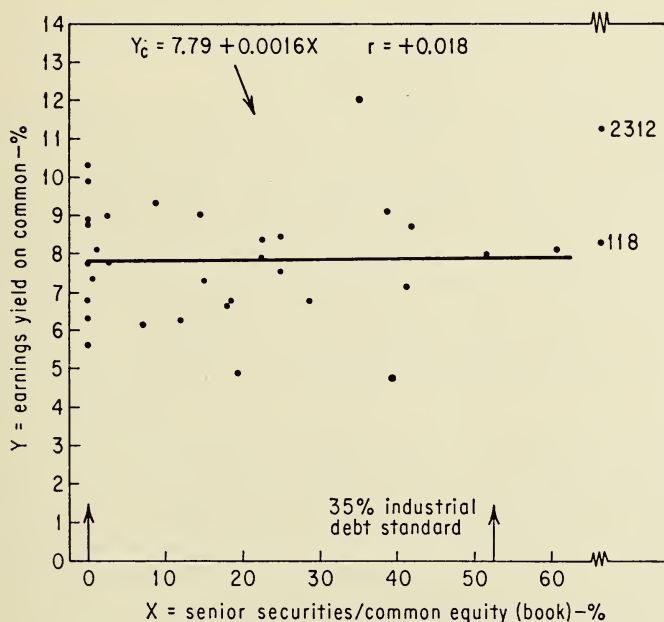


Fig. 5.22. The relationship between earnings yield on common and the ratio of debt plus preferred to common equity, 32 cement companies, 1956.

The statistical test in this case was conducted on a somewhat different basis from the others. Specifically, the regression line was fit to only the first 32 observations and covers the debt/equity ratio up to 60%, which is only slightly above the conventional debt standard. This was done, first, to avoid the influence of the extremes on a straight-line fit and, second, because the higher yields of the two extremes are

not inconsistent with traditional views. The straight-line fit up to the conventional debt limit produced a coefficient of correlation of $+0.018$, which is not statistically significant and which is consistent with the conclusions suggested by the other tests for yields up to the conventional debt limit.

In addition to the above regression tests, the yield test for the cement companies can be conducted on another basis. Specifically, because there are a fairly large number of observations with little or no debt, it is possible to divide the sample in two—those with debt and those with no debt—calculate the mean yield for the two samples, and test for the significance of the difference between the means. This type of test gives no information regarding the specific relationship between yield and financial risk, but it has the advantage of avoiding all questions of measurement of financial risk and of possible unsuspected biases in the use of book debt ratios.

For purposes of conducting a significance test for differences, the entire cement sample was split into two groups. Sample 1 consists of 10 observations with senior security debt ratios between 0.0% and 1.3% and with a median of 0.0%. Sample 2 consists of 24 observations which all have some debt and which have a median senior security debt ratio of 23.7%. Thus, the Sample 1 firms have no financial risk, as defined; Sample 2 has on average a significant—but moderate—amount of financial risk. The mean yield for Sample 1 is 7.97% while the mean yield for Sample 2 is 7.90%; the difference is obviously not significant. Not all cement companies reported their sales figures for 1956, but the available evidence does not indicate that there is any tendency for smaller firms to dominate Sample 1 (see Appendix A). Thus, there does not appear to be any upward bias on the mean yield of Sample 1 from this source. This test, which is based on a fair number of degrees of freedom and which avoids questions of measurement of financial risk, tends to discredit the hypothesis that investors require higher yields for moderately-levered firms than for unlevered firms.

CHAPTER 6

Theoretical Findings

6.1. The Yield Relation and the Arbitrage Process

In their paper on cost of capital Modigliani and Miller state that the reasoning behind traditional beliefs in a U-shaped cost of capital curve is not very clear.¹ They suggest that the traditional view reflects the feeling that moderate amounts of debt in sound corporations do not add very much to the riskiness of the stock, and that therefore noticeably higher yields are not required to induce investors to hold the stock. They then cite as typical the following statement by Guthmann and Dougall:²

Theoretically it might be argued that the increased hazard from using bonds and preferred stocks would counterbalance this additional income and so prevent the common stock from being more attractive than when it had a lower return but fewer prior obligations. In practice, the extra earnings from 'trading on the equity' are often regarded by investors as more than sufficient to serve as a 'premium for risk' when the proportions of the several securities are judiciously mixed.

The foregoing statement by Guthmann and Dougall does imply a relatively horizontal yield relation, and therefore a declining cost of capital curve, without indicating the whys of investor behavior. While this is true, it is interesting to see how far M & M have gone

¹ *Op. cit.*, p. 278.

² Guthmann and Dougall, *Corporate Financial Policy*, 3rd ed. (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1955), p. 245.

in supplying answers to the question of why. Thus, M & M have presented a yield relation which is more than an equation; it is a description of investment market behavior in response to debt ratios in a perfect market—and a rather rigid response behavior at that. This being the case, it is both pertinent and important to examine the logic behind the relation to see just exactly why investors behave as hypothesized.¹

It will be recalled from Chapter 1 of this paper that the M & M Proposition I states that: “the average cost of capital to any firm is completely independent of its capital structure and is equal to the capitalization rate of a pure equity stream of its class.” In equation form:

$$\frac{\bar{X}_j}{(S_j + D_j)} = \frac{\bar{X}_j}{V_j} = p_k \quad (1)$$

where:

$\bar{X}_j$ = the expected future profits of Company J before deduction of interest.

S_j = the market value of the common shares of Company J.

D_j = the market value of the debts of Company J.

V_j = the total market value of Company J.

p_k = the expected rate of return on the common stock of an unlevered company in class k .

$\bar{X}_j/V_j$ is defined as the average cost of capital of Company J.

Similarly, Proposition II states that: “the expected yield of a share of stock is equal to the appropriate capitalization rate p_k for a pure equity stream in the class, plus a premium related to financial risk equal to the debt-to-equity ratio times the spread between p_k and r .” That is:

$$i_j = p_k + (p_k - r) D_j/S_j \quad (2)$$

¹ In the discussion and analysis which follows certain simplifications have been made. As before, the equations abstract from income taxes. In addition, only one aspect of the arbitrage process is discussed, namely, the case where a levered firm sells at a higher valuation than an unlevered firm. This case contains the basic ideas of the arbitrage process. For refinements, qualifications, and the opposite case of a levered firm selling below an unlevered one, the reader is referred to the M & M article.

where:

i_j = the expected rate of return on the common stock of Company J.

r = the capitalization rate for sure income streams, or simply, the rate of interest.

In order to arrive at the above yield relation M & M take as a starting point the following definition of expected rate of return on common stock:

$$i_j = \frac{\bar{X}_j - rD_j}{S_j} \quad (3)$$

That is, the expected yield on stock of Company J is equal to the expected future profits of Company J, less interest, divided by the market value of the common stock of Company J. From the equation of the average cost of capital hypothesis (1) they then solve for $\bar{X}_j$ and arrive at the following:

$$\bar{X}_j = p_k(S_j + D_j) \quad (4)$$

Substituting the above in equation (3) and simplifying, they obtain equation (2).

From the above equations it should be clear that the yield relation (2) has no independent logic. It is derived completely from a definition of average cost of capital, from a definition of expected yield, and from a hypothesis about average cost. Therefore to understand the logic behind the relation it is necessary to turn to the logic of the average cost of capital hypothesis.

In order to explain the logic of Proposition I it will be convenient to restate the proposition in a slightly different, but equivalent, way, namely, in terms of market value. In terms of market value, Proposition I states that: "the market value of any firm is independent of its capital structure and is given by capitalizing its expected return at the rate p_k appropriate to its class." This alternative statement follows from equation (1):

$$\frac{\bar{X}_j}{(S_j + D_j)} = \frac{\bar{X}_j}{V_j} = p_k \quad (1)$$

Solving for V_j , the alternative formulation of Proposition I is obtained:

$$V_j = \bar{X}_j / p_k \quad (5)$$

The implications of Proposition I should be clear. Thus, given two companies which are identical in every respect, except that one has debt while the other does not, their total market values must be the same. The levered company cannot sell at a higher valuation than the unlevered company—as is commonly thought. The reason given for this by M & M is that, in a perfectly competitive market, if a levered firm sold at a greater valuation than an unlevered one, rational investors acting in their best interests would find it profitable to put an equivalent amount of leverage into their personal portfolios and buy the shares of the unlevered firm. In other words, if a levered company sold at a greater total valuation than an unlevered company, an arbitrage process would start which would tend to eliminate the inequality. It is important to recognize that this M & M hypothesis is advanced as a description of behavior in a perfectly competitive market. In real life, institutional restrictions and/or ignorance could prevent the arbitrage process from bringing about equality or near equality.

To clarify the arbitrage process somewhat, an illustrative hypothetical example will be given. For this purpose two relatively stable, hypothetical firms are taken, which are assumed to be identical in every respect except that one firm has some debt while the other has none. The expected average future income and other assumed information is presented below:

	Company A	Company B
Expected Income ($\bar{X}$)	\$10,000	\$10,000
Debt (D)	—	\$30,000
Interest—4% (rD)	—	\$ 1,200
Expected Shareholder Return ($\bar{X} - rD$)	\$10,000	\$ 8,800
Capitalization Rate	10%	11%
Value of Common Stock (S)	\$100,000	\$80,000
Value of Firm ($S + D = V$)	\$100,000	\$110,000
D/V	—	27.27%
D/E	—	37.50%

As will be seen from the data, the market value of Company B—the levered firm—has been assumed to be greater than the market value of the unlevered Company A. This condition, it will be recalled, cannot persist in a perfect market according to the M & M hypothesis. It should also be noted from the figures that an allowance was made in the yield of the stock of Company B to compensate to some degree for the presence of debt in that company. The selection of the 11%

figure for Company B was not made on any assumptions as to what constitutes adequate compensation for the presence of debt, but was made simply to show that a levered company could have both a higher stock yield and a higher total valuation than an unlevered company. According to Proposition I, however, the disparity in market values is not possible in a perfect market, which means that in this particular example the yield of Company B must go up to give greater compensation for financial risk (thereby reducing market value), or the yield of Company A must go down (thereby increasing market value), or both.

To see the way in which equality in market values is brought about it is only necessary to assume further an investor who holds, say, \$10,000 worth of the stock of Company B. Given this and the yield of 11%, the expected dollar return on his investment will be \$1100. Now the M & M theory states that, given the disparity in the market values of Company A and Company B, this investor will find it profitable to: (1) sell out his stock in Company B; (2) borrow \$3750; and, (3) use his equity and the borrowed money to buy \$13,750 worth of the stock of Company A, using the newly acquired stock as collateral for the loan. After completion of this operation the investor will be subject to the same degree of leverage as he was when he held the stock of Company B, i.e., 27.27%, but the net income on his portfolio after deducting his own borrowing costs of 4% will be \$1225—some \$125 greater than before. The action of this investor, and of others who are in a similar position, will tend to increase the yield of Company B and decrease the yield of Company A—thereby bringing about an equality in the total market values of the two companies.

In connection with the above arbitrage process M & M make the following statements at two points in their paper:

The exchange would therefore be advantageous to the investor quite independently of his attitudes toward risk. (p. 269)

Our Propositions I and II, as noted earlier, do not depend for their validity on any assumption about individual risk preferences. Nor do they involve any assertion as to what is an adequate compensation to investors for assuming a given degree of risk. (p. 279)

This writer submits that the M & M arbitrage process does depend for its validity on assumptions as to what constitutes adequate com-

pensation to investors for assuming a given degree of risk. There are several reasons for this. In the first place the risks of personal leverage through margin and the risks of leverage through the corporation are different. In the case of margin the investor assumes unlimited liability with respect to the debts incurred whereas in the case of corporate leverage the liability to creditors is limited. This point was made by Professor Durand in a comment on the M & M paper,¹ and can be seen in the hypothetical situation described above. If, for example, the expected incomes of companies A and B were to suddenly drop to zero the hypothetical investor would stand to lose up to \$10,000 if he held stock B, and up to \$13,750 if he held stock A, i.e., his \$10,000 equity plus the \$3750 borrowed money. Even if the expected income of the two firms did not change, the holding of stock A on margin would present greater risks; a decline in stock prices, either temporarily or permanently, would create the possibility of a greater percentage decline in the investor's equity and/or the possibility of a margin call at an inopportune time. Now to state that the hypothetical investor described above will find it profitable to purchase stock A on margin is to assume that the additional \$125 income he obtains will compensate him for the additional risks he incurs in holding stock A on margin. In a reply to the Durand comment that personal and corporate leverage differ in risk,² M & M argue in essence that personal leverage and business leverage must be good substitutes in view of the fact that their empirical findings are consistent with their theoretical propositions. Putting aside the question of the validity of the data, this position by M & M fails to recognize that an assumption is nevertheless made about individual risk preferences.

It would not seem to be incorrect to state that many investors, if not the majority of investors, do not buy stocks on margin and are not interested in doing so, except under the most unusual circumstances. Such behavior is not necessarily irrational; it reflects the aversion of such investors to the risk of a sudden margin call at an inopportune time. If this is granted, it can be shown that equality in market values between levered and unlevered companies need not be brought about, even though there are a number of investors who

¹ David Durand, "The Cost of Capital, Corporation Finance, and the Theory of Investment: Comment," *American Economic Review* (September 1959), p. 646.

² Modigliani and Miller, "The Cost of Capital, Corporation Finance, and the Theory of Investment: Reply," *American Economic Review* (September 1959), pp. 656-57.

would indulge in the kind of arbitrage process described above. Thus, assume a population of investors consisting of investors who want nothing to do with margin and of investors who are not so averse to margin buying. Given the disparity in market values between Companies A and B described above, the investors who are not averse to margin would then find it profitable to engage in the arbitrage hypothesized by M & M. Sale of stock B would occur, driving its yield up, and purchase of stock A would occur, driving its yield down. Now is it not possible that as the yield on stock A declines, some of the original shareholders of stock A will find this lower yield inadequate compensation to them for the risks incurred in holding stock A? Furthermore, is it not possible that some of these investors—the ones who do not like margin—will now find stock B more attractive with its higher yield, relative to the risks? If so, then it is entirely possible that switching will occur from stock A to stock B as well as from stock B to stock A and that equality in market values will not be achieved. In describing their arbitrage process M & M ignore, as far as this writer has been able to determine, possible induced reactions resulting from the arbitrage process. Yet in ignoring induced reactions they have implicitly assumed that the new yield relationships which result will continue to be satisfactory risk compensation to *original* stockholders.

In addition to the above, the M & M arbitrage process also assumes that margin operations other than the one described will not yield a sufficient compensation to investors for the risks involved in such other margin operations. For example, what would happen if the hypothetical investor described above, instead of using the \$3750 borrowed money to purchase shares of Company A, used the money to increase his investment in Company B? He would, of course, be subject to a greater degree of leverage (on a combined basis) than if he had used the funds to buy stock of Company A. But the net income from his portfolio would be \$1362—\$262 more than before the borrowing and \$137 more than if he had sold out and borrowed to buy shares of Company A. This additional net income of \$262 or \$137—depending on the point of reference—could conceivably be more than sufficient to compensate the investor for the added leverage risk he faces. If this were in fact the case, then the opposite of what M & M hypothesized would occur, that is, borrowing to buy shares of Company B would occur, forcing down the yield of stock B and increasing the difference in the total market values of Companies A and B. It is not intended to suggest that this result is superior to that hypothesized by M & M,

but rather to suggest that, if induced reactions are ignored, this result is as plausible as that hypothesized by M & M. M & M, in ruling out increased investment in Company B through margin buying, assume that the additional net income would not be sufficient to compensate the investor for the added leverage risk he would face.

In order to better appreciate the nature of the assumptions made by M & M it will be worthwhile to examine the nature of the risks confronting the stockholders of the assumed Companies A and B. To see the risks faced by stockholders of these companies it is necessary to set up some kind of (subjective) probability distribution for the average future income of the two companies. For this purpose, the vantage point taken is that of an individual investor who currently holds shares of one of the two companies and who is considering an increase in his investment in the same company or a switch. As the two companies are assumed identical, except for debt, the probability distributions for the incomes before interest should be the same. Assume, then, that after some analysis a hypothetical investor mentally arrives at the subjective probability distributions shown below.

Company A (no debt)	Company B (levered)		
Possible Average Shareholder Returns (same as returns before interest) X	Possible Average Returns Before Interest X	Possible Average Shareholder Returns ($X - \$1,200$)	Subjective Probability Distribution
\$ 7,000	\$ 7,000	\$ 5,800	.05
8,000	8,000	6,800	.10
9,000	9,000	7,800	.20
10,000	10,000	8,800	.30
11,000	11,000	9,800	.20
12,000	12,000	10,800	.10
13,000	13,000	11,800	.05
$\bar{X} = \$10,000$	\$10,000	\$ 8,800	1.00

From the assumed probability distributions some useful conclusions about the relative risks of companies A and B can be reached. First of all, it will be noted that with an expected income of \$10,000 and with interest costs of \$1200, the expected average future interest

¹ The expected average future income (the expected value) $\bar{X}$, is a weighted average and is obtained by multiplying each income by its appropriate probability and then summing the products.

coverage of Company B is 8.33 times. The lowest probable income for Company B is \$7000, which means then that the lowest probable average interest coverage in future years is 5.83 times. In the eyes of this hypothetical investor, therefore, the probability of default by Company B in the future is nil.

It will also be noted that while the absolute ranges of the three distributions are the same (\$6000), the ranges relatively to the expected incomes are different. Thus, the lower limit of Company A income is \$7000, which represents a potential loss of 30% from the expected income ($\bar{X} = \$10,000$). On the upside the potential gain is also 30%. These potential gains and losses from expected income also apply to the distribution of income before interest for Company B. The picture for the income after interest for Company B, however, is quite different. In this case, the lower limit of the distribution is \$5800, and this represents a potential loss of 34.1% from the expected income of \$8800. On the upside the potential gains are also 34.1%. Inasmuch as the potential gains and losses of Company B shares are greater than for Company A shares, it must be concluded that the shares of Company B are more "risky" than the shares of Company A.

It is at this point that the assumptions of the M & M arbitrage process appear most clearly. Having concluded that the shares of Company B are more risky than the shares of Company A, what premium over stock A will this investor require to consider buying Company B shares? Will it be $\frac{1}{2}\%$, 1%, $1\frac{1}{2}\%$, 2%, or what? The answer, of course, will depend on the aversion of this particular investor to risk, which in turn will depend on his age, sex, etc. Each investor will probably require a slightly different premium because of differences in taste and ability to bear risk. Now M & M hold that their theory makes no assumption about individual risk preferences and therefore avoids this problem of premium required by an individual investor. But the arbitrage process holds that investors *as a class* will require a yield premium on Company B such that the total market values of companies A and B will be the same. This is tantamount to assuming that the net effect of the different risk aversions of hundreds of thousands of investors will be such as to produce a yield premium which will bring the total market values of companies A and B into equality.¹

¹ In this connection it is relevant to note the following statement made by M & M in a footnote to their paper:

We cannot, on the basis of the assumptions so far, make any statements about the relationship or spread between the various *p*'s or capitalization rates. Before we could do so we would have to make further specific

In sum, then, it is the opinion of this writer that the M & M arbitrage process does rest on assumptions about investor risk preferences and that the theoretical validity of the M & M risk relation and of the M & M Proposition I is open to serious question.¹ and ²

assumptions about the way investors believe the probability distributions vary from class to class, as well as assumptions about investors' preferences as between the characteristics of different distributions. (Note 10, p. 267)

This statement seems somewhat incongruous with the earlier position. On the one hand M & M state that statements about the spread of p 's between classes cannot be made without making assumptions as to investors' preferences toward different distributions, and yet on the other hand they hold that statements can be made about yield spreads within a class *without* making assumptions as to investors' preferences toward different distributions.

¹ Before leaving this section on the arbitrage process, it is relevant to point out that Professor J. Fred Weston, in his recent published article, criticizes the arbitrage process on somewhat different grounds. Thus, in his article, Professor Weston states:

The proof depends upon the assumption that an individual who takes stocks with high leverage to a financial institution can borrow to a smaller extent than can persons who take stocks in unlevered companies to use as security for borrowing. (p. 135)

He then goes on to state that:

This obviously and patently is not in accordance with the facts of business life.

Actually, that the assumption is not in accordance with the facts is not really relevant, for the M & M framework is one of perfect markets, which we clearly do not have. The relevant criticism in this case, it is felt, is that M & M have failed to establish on theoretical grounds the validity of the relationship between bank lending and degree of leverage which is assumed in their arbitrage process. In other words, why the linear relationship? What is the risk aversion of bankers? Cannot bankers be induced, with a little extra interest, to lend a little more on leveraged stocks?

² In their paper M & M make the following statement:

A number of writers have stated close equivalents of our Proposition I although by appealing to intuition rather than by attempting a proof and only to insist immediately that the results were not applicable to the actual capital markets. (p. 271)

They then refer the reader to J. B. Williams, *The Theory of Investment Value* (Cambridge: Harvard University Press, 1938), pp. 72-73, among others.

It is instructive to quote the relevant passages to which M & M refer. Thus, in his volume on pp. 72-73 Professor Williams makes the following statements:

6.2. Equations

Up to this point the discussion of the M & M theory of equality in market values of levered and unlevered firms and of the arbitrage process has been conducted without critically examining the M & M equations. This omission was deliberate inasmuch as the theory is quite independent of the equations. In other words, one could ignore the equations entirely and still conduct an argument on the arbitrage process, although it would be less convenient to do so. However, besides being convenient, the use of the equations by M & M adds a certain force to their theory which would not be present without them. It is therefore both appropriate and important at this time to critically examine the equations.

Clearly if a single individual or a single institutional investor owned all the bonds, stocks, and warrants issued by a corporation, it would not matter to this investor what the company's capitalization was. Any earnings collected as interest could not be collected as dividends. To such an individual it would be perfectly obvious that total interest—and dividend—paying power was in no wise dependent on the kind of securities issued to the company's owner. Furthermore, no *change* in the investment value of the enterprise as a whole would result from a *change* in its capitalization. . . . Such constancy of investment value is analogous to the indestructibility of matter or energy; it leads us to speak of the Law of the Conservation of Investment Value, just as physicists speak of the Law of the Conservation of Matter.

Since market value does not usually conform exactly to investment value, no 'conservation of market value' is to be found in general. Only to a rough extent do total market values remain the same regardless of capitalization.

There would seem to be little quarrel with the validity of the notion expressed in the first passage cited, namely, that capital structure is a matter of indifference to an individual who owned the whole enterprise. Note, however, that while this is true, to generalize this conclusion to the case of companies held by many investors runs the serious risk of committing a *fallacy of composition*. While Professor Williams states that market values do not usually conform to investment values, he does state there is a tendency in this direction, and he does seem to be appealing to intuition on this idea of indestructibility of investment value and indifference of capital structure. But this seems improper, for the fact is that when we deal with market values we deal with companies which are held by different groups of people who have *different investment needs* and *different aversions to risk*. It is the opinion of this writer that there is no sound basis for extending the idea of the value of a firm to one individual to the value of a firm to many investors with different needs.

It will be recalled that in the process of deriving the earnings yield relation M & M defined the expected rate of return on common stock as follows:

$$i = \frac{\bar{X} - rD}{S} \quad (3)$$

where:

i = the expected rate of return on common stock.

$\bar{X}$ = the expected future profits of Company J before deduction of interest.

D = the market value of the debts of Company J.

r = the rate of interest.

S = the market value of the common stock of Company J.

The above definition of expected rate of return is given by M & M in their paper without explanation.¹ Yet there is some question as to the place of the above equation in theoretical work. For example, in obtaining an estimate of the future stockholder dollar return, an experienced stock analyst will usually first estimate the total profits of a firm, and then deduct an estimate of interest and income taxes. If income taxes did not exist, an experienced analyst would then presumably obtain an estimated stockholder return by estimating total profits, and then subtracting an *estimate* of interest to be paid in the future. Note carefully, however, that in the above formulation of expected shareholder rate of return, M & M obtain the expected shareholder return—i.e., the numerator—by taking estimated total profits and then deducting *current* interest costs—that is, *today's* interest costs. Now in empirical work one may use current interest costs as an estimate of future interest costs, but for any given company it must be recognized that security analysts and investors may expect future interest costs to be equal to, greater than, or less than current interest costs.

Viewed somewhat differently, current interest costs are known with certainty, whereas future interest costs are not. As such, the expected future interest costs of a company are a random variable with an expected mean value. Since the yield of a stock refers to the expected future yield, the variables used in its formulation should be consistent with the definition. Otherwise, the formulation will not give what it

¹ Cf., *op. cit.*, p. 271.

purports to give. It may be that for any given company the difference between current interest costs and expected future interest costs is small, but the question here is not one of extent; the question here is whether it is logical to use current interest costs when dealing in the pure theory of expected stock yields. A more logical formulation of expected shareholder rate of return, it seems, would be one which recognized that future management financial policies and future interest costs, as well as future income from assets, are not known with certainty. Such a formulation would be as follows:

$$i = \frac{\bar{X} - \bar{I}}{S} = \frac{\bar{X}_c}{S} \quad (6)$$

where:

i , $\bar{X}$ and S are the same as before.

$\bar{I}$ = the expected average future interest payments.

$\bar{X}_c$ = the expected return to common shareholders.

and where:

$\bar{I} = f$ (present debt retirement schedules, future management financial policies, future interest rates, etc.)

This question of the formulation of expected rate of return is of more than academic interest; the conclusions reached on average costs and risk-premium relationships will depend on the formulation adopted. M & M, for example, start with the basic proposition that the average cost of capital for any firm is equal to a constant—i.e., the rate of capitalization of an expected unlevered income stream in the class. As they define average cost, this proposition states that the total *current* market valuation of a firm's expected future income from assets is a constant, no matter how income is distributed among various security holders. Symbolically:

$$\frac{\bar{X}}{S + D} = \frac{\bar{X}}{V} = p_k \quad (1)$$

If the above relationship is true, then some relationship between stock yield and debt is implied. M & M hold that this implied relationship is Proposition II; that is:

$$i = p_k + (p_k - r)D/S \quad (2)$$

The implied relationship, in turn, was obtained by solving for $\bar{X}$ in Eq. 1 and substituting in their formulation of yield (Eq. 3), and sim-

plifying. Thus, Eq. 3 and Proposition II are inextricably bound and cannot be separated. Now if one holds that the M & M formulation of expected yield is untenable, and that Eq. 6 above is logically superior, then, it is felt, one of the four following conclusions must be reached:

- (1) Proposition I does not imply Proposition II; or,
- (2) the definition of average cost of capital in Eq. 1 is incorrect; or,
- (3) the constant, p_k , in Eq. 1 is incorrect (i.e., average cost is not equal to a constant); or,
- (4) a combination of (1), (2), or (3) above.

This writer does not wish to pass judgement about which of the above conclusions is the more plausible. The point that the writer wishes to make, however, is that, from the standpoint of *pure theory*, certain of the M & M conclusions are suspect.¹

6.3. Probability Distributions

In earlier parts of this paper several illustrative hypothetical investor probability distributions were given which were assumed to be symmetrical. In this section the opposite case of asymmetrical distributions is explored. In their paper M & M do not take up the matter of the shapes of investor probability distributions nor the significance of the shapes of such distributions for the yield relation. Nevertheless, it is felt that a discussion of these distributions can contribute to a better understanding of yield-risk relations and, in turn, of the average cost of capital. The plan is to consider two hypothetical cases under varying assumptions and then to draw conclusions. The situations are not intended to answer all questions regarding investor probability distributions, but rather to indicate the effect which

¹ It should be noted in this connection that the M & M definition of average cost given above in Eq. 1 is not strictly speaking a weighted average cost definition. A weighted average cost definition would take the following form:

$$\frac{\frac{(\bar{X} - \bar{I})}{S} S + \frac{I}{D} D}{S + D} = \frac{(\bar{X} - \bar{I}) + rD}{S + D} = \frac{\bar{X}_c + rD}{S + D}$$

where:

$\bar{X}$, $\bar{I}$, S , D , and r are the same as before.

$I = rD$ = current interest costs.

$(\bar{X} - \bar{I}) = \bar{X}_c$ = expected shareholder dollar return.

varying assumed probability distributions can have on generalizations about financial risk and the shape of yield relations.

Case I. The first case taken is that of the hypothetical investor assumed earlier in this chapter who is evaluating the prospective incomes and risks of Companies A and B. It will be recalled that in that case it was assumed that: (1) both companies were identical in every respect except debt; (2) the expected average income from assets of both companies was \$10,000; (3) the interest on debt of Company B, which is now taken as expected interest, was \$1200; and (4) the probability distributions of the average incomes were symmetrical with limits of \$7000 and \$13,000. Assume now that, instead of symmetrical distributions, this hypothetical investor mentally arrived at approximately the following asymmetrical distributions, which have the same expected value as before:

Such asymmetrical distributions as the above might arise for a number of reasons, but one possibility which occurs to this writer is the prospect of inflation. If, for example, the hypothetical investor felt that the probability of inflation in the future were greater than the probability of price stability or deflation, and if he were not able to reliably estimate the extent of inflation and its effect on profits, he might well assign probabilities to the higher values of average income for the two companies. If skewed probability distributions are assumed for the average income from assets the expected value would be the same for the two companies. Thus, the distribution of possible average income from assets for Company B will be the same as the

The above definition of average cost is the definition most frequently given by writers (see references below). Note that the weighted average definition of average cost and the M & M definition of average cost can give different results, since $(\bar{X}_e + rD)$ can be greater than or less than $(\bar{X})$.

If M & M were to adopt the weighted average definition in Proposition I and also the suggested definition of expected yield in Eq. 6, they could, through substitution and simplification, arrive at their original Proposition II yield relation. In so doing, however, the market-value formulation of Proposition I would change, for in this case it would be found that the market value of the firm is *not* independent of capital structure. That is,

$$V = \frac{(\bar{X} - \bar{I}) + rD}{p_k} \begin{matrix} \leq \\ \geq \end{matrix} \frac{\bar{X}}{p_k}$$

Cf., Hunt, Williams, and Donaldson, *Basic Business Finance* (Richard D. Irwin, 1958); F. B. Allen, "Does Going Into Debt Lower the 'Cost of Capital'?", *The Analysts Journal* (August 1954), p. 57; J. Fred Weston, *op. cit.*, p. 136.

Company A (no debt) Possible Average Incomes (same as possible average incomes to share- holders)	Company B (levered) Possible Average Incomes to Shareholders (possible average incomes less \$1200)	Probability
\$ 7,000	\$ 5,800	.05
8,000	6,800	.20
9,000	7,800	.23
10,000	8,800	.15
11,000	9,800	.11
12,000	10,800	.08
13,000	11,800	.07
14,000	12,800	.06
15,000	13,800	.05
Expected Income ($\bar{X}$): ¹ \$10,000	\$ 8,800	1.00

distribution for Company A given above, and the expected income in both cases is \$10,000. The distribution of average returns for shareholders of Company B is obtained, as before, by subtracting the \$1200 expected interest from the probable average incomes from assets.

In the case where the probability distributions were assumed symmetrical it was found that the potential gains and losses to the shareholders of Company A were $\pm 30\%$ while the potential gains and losses to the shareholders of Company B were $\pm 34\%$. Now when potential shareholder gains and losses are calculated from the skewed distributions the percentages run -30% to $+50\%$ for Company A and -34% to $+57\%$ for Company B. It will be noted that the potential percentage losses in both cases are the same as before, but that the potential percentage gains are greater, and in the case of Company B the potential gains are greatest. If Company B had a greater amount of expected interest—that is, if more leverage were employed—the skewness of the distribution of average returns to shareholders of Company B would be greater yet, and the potential gains of stock B, relative to stock A, would also be greater than in the above case. With the same level of interest, \$1200, the potential gains would also be greater for stock B if inflationary sentiment were stronger. If inflationary sentiment were strong the distribution of returns from assets for both companies would be more skewed, but after deducting interest

¹ As before, the expected value is obtained by multiplying each income by its probability and adding together all the products.

of \$1200 for Company B the distribution of shareholder returns would be more skewed, relative to Company A, and the potential gains would be greater. This relationship between the skewness in the distribution of shareholder returns and the debt/equity ratio has been summarized in Fig. 6.1. The chart shows two curves, one under the assumption of moderate inflationary sentiment (A) and the other under the assumption of strong inflationary sentiment (B). Point "a" on the chart shows the degree of skewness in the distribution of returns from assets for class k firms under the assumption of moderate inflationary sentiment, and is also the degree of skewness in the distribution of shareholder returns for the debt-free firm in class k . Point "b" shows the skewness for the same distributions under the assumption of strong inflationary sentiment. The rise in the two curves simply reflects the view that the potential dollar gains to shareholders, relative to both potential losses and potential gains for debt-free firms, increase with the debt/equity ratio, where the chances of inflation are greater than the chances of deflation.¹

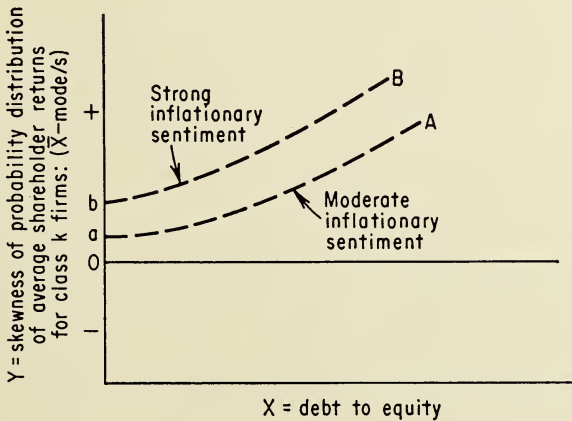


Figure 6.1

Case II. The second case examined is the hypothetical case of two class k firms under the assumption of expected price stability. Both

¹ It is not certain that the curved lines in Fig. 6.1 correctly depict the relation between skewness and debt to equity. The correct relation could be a straight line. For present purposes, however, the exact relation is not important; the important thing is that skewness increases and that the line goes up as debt increases.

firms, A and B, have the same expected average returns from assets, \$10,000, and the probability distribution of returns from assets is pictured by curve A in Fig. 6.2. Firm A is assumed to have no debt; the probability distribution of shareholder returns will then be identical with curve A in Fig. 6.2. Firm B is assumed to have debt to the extent that expected average interest payments are \$7000. In Fig. 6.2 the probability distribution of returns to shareholders of Company B is represented by curve B, which was obtained by shifting the A curve down by \$7000. Note that curve A has been drawn in such a way that 10% of the area of the curve falls below \$7000.

From the chart it will be noted that the potential gains and losses to the shareholders of unlevered Company A run from +50% to -50% from the expected average returns. In the case of Company B the limits of the distribution of returns to shareholders are +166% and -166% from the expected average of \$3000. Now strictly speaking such potential gains and losses as exist for the owners of Company

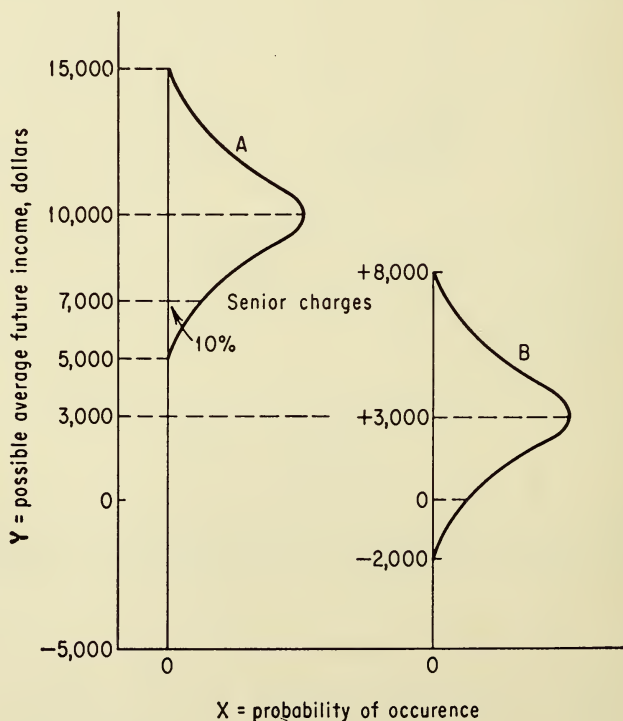


Figure 6.2

B are relevant only if unlimited liability attaches to the shares of Company B and if the owners have substantial personal assets. If unlimited liability attached to shares, and if the owners had substantial personal assets, then potential average future losses of \$2000—which could occur according to the probability distribution—would be of significance to the owners, for they would be called upon to make up the deficiency for the creditors. In this case, where unlimited liability exists and where the owners have substantial personal assets, the probability of default on the debt is zero. With such relatively wide limits for the distribution of returns to owners of Company B, however, the shares of Company B are obviously very risky relative to the shares of Company A.

The usual case in modern business corporations today is limited liability of owners to creditors. Assuming limited liability in the above example, the probability of Company B defaulting on its debts in the future is 10%, and is indicated by the portion of the area of curve A that falls below \$7000. (Curve A, it will be recalled, is also the distribution of average returns from the assets of Company B.) With limited liability, however, average losses of \$2000 in the future are without significance to the owners of Company B. The relevant lower limit of the distribution of returns to Company B owners is zero dollars average return instead of the —\$2000. Note the effect of this limited liability on the distribution of returns to the shareholders of Company B. The probability distribution is now represented by the entire area of curve B which lies above zero dollars, and which now becomes unity. The new probability distribution is skewed, and most important, the expected value ($\bar{X}$) shifts upward—in this case to about \$3500, from \$3000. With an expected average return to shareholders of \$3500 the potential percentage gains and losses to shareholders would then run from —100% to +129% from the expected value. The potential losses to Company B shareholders are still greater than for Company A shareholders, but in this case the potential gains and losses are not symmetrical; potential gains exceed potential losses by a fair amount.

If the \$7000 payments to the senior security holders of Company B were entirely preferred dividends the probability distribution of returns to common shareholders would probably be different from the above case of pure debt. Suppose in this case that the average future income from the assets of Company B turned out to be only \$5000 and that preferred dividends were not met. In this case the company would not go into bankruptcy, nor would the common stockholders be

wiped out. Instead, there would be a good chance of a voluntary recapitalization occurring in which the common stockholders could salvage something for themselves. What the common stockholders could salvage in a voluntary recapitalization would depend on the position of the preferred stockholders vis-à-vis the common stockholders. However, if the terms of the preferred issue were not particularly strong the common stockholders would probably salvage some positive income. In terms of the probability distribution of returns to the common stockholders of Company B, the relevant lower limit of the curve (B) would be some positive value, such as \$1000 or \$2000. In this case the probability distribution of common returns would be more skewed than in the case of bonds. In addition, the expected value would shift up again, while the potential gains would exceed the potential losses by a greater amount than in the case of bonds.

From the above it follows that the probability distribution of returns to common stockholders is a function of the following three things: (1) the probability distribution of average returns from assets; (2) the amount of expected senior charges; and (3) the strength of the terms of the senior securities. In addition to expectations as to inflation or deflation, the degree of skewness in the probability distribution of average returns to common shareholders will be influenced by (1) the level of expected senior charges and the intersection of this level with the lower end of the probability distribution of returns from assets, and (2) the strength of the terms of the senior securities and expectations as to how the senior security holders would stand up in reorganization or recapitalization vis-à-vis the common stockholders.

The relationship between the skewness in the probability distribution of common returns and the debt/equity ratio for class k firms is presented graphically again in Fig. 6.3. In this case it has been assumed that price stability is the expectation and that the variability in the distribution of average returns from assets for class k firms is not too great. On the basis of these assumptions, it will be noted that the use of debt up to a certain point (X_1) creates no skewness in the distribution of common returns. The relative variability in the distribution of common returns will increase as debt is utilized, but the limits of the distribution will still continue to be symmetrical around the expected value. Beyond X_1 the use of debt will create skewness in the distribution of common returns, because of the limited liability. X_1 is the point where the level of senior charges intersects the lower limit of the probability distribution of returns from assets. Note that at this point the potential gains to common shareholders begin to exceed the potential losses. As debt is used beyond this point

the degree of positive skewness will increase, as will the positive difference between potential gains and potential losses. If the senior securities consist of preferred stock positive skewness will start at an earlier point than in the case of pure debt, and this has been indicated by point X_2 and curve B in the chart. Note also that if the distribution of returns from assets of class k firms had been assumed positively skewed for some reason such as inflation, the probability distribution of common returns would get a double dose of positive skewness if debt were used beyond the X points.

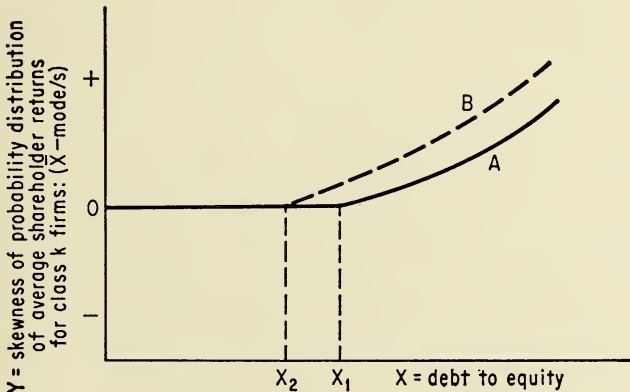


Figure 6.3

Conclusions. What conclusions can be drawn from the foregoing analysis which bear on the question of the yield-risk relation?

In the first place, it should be evident by now that the expected shareholder dollar return is not so easily obtained as implied by either $(\bar{X} - \bar{I})$ or $(\bar{X} - rD)$. That is to say, if one subtracts either current or expected interest payments from the expected average income from assets he cannot be sure he will obtain the expected average return for shareholders. In their paper M & M give an illustration using their formula in which they obtain expected shareholder income by subtracting interest from expected average income from assets (p. 271). But this procedure could give an expected value which is too low. To see this the reader should consult Fig. 2.1 on p. 26, where the expected shareholder return was obtained as follows: $\$10,000 - \$4000 = \$6000$. This result should be compared with the result pictured in Fig. 6.2 and discussed on p. 135: $\$10,000 - \$7000 = \$3500$. This latter result occurs because, as debt is employed in increasing amounts, a point is reached where the probability distribution of returns to shareholders

is truncated because of the limited liability. Note also that in this case the expected value for the senior security holders is \$6500, which means that some risk attaches to their promised receipts of \$7000. The fact that risk attaches to so many bonds which are traded in public markets today, suggests that many common stockholder probability distributions are skewed because of the limited liability feature of their shares. Thus, there is some question as to whether the M & M Proposition II, which assumes no truncation of investor probability distributions, can adequately predict the yields which investors expect and the risk premiums which they require.

In the second place, it should be evident that different senior securities can affect shareholder probability distributions differently. In other words, different senior securities can present different risks to common shareholders. When the amount of senior capital employed is small, the effect of different senior securities on shareholder probability distributions tends to be the same. When the amount of senior capital employed is large, however, the effect of different senior securities on shareholder probability distributions will tend to be different. Specifically, different senior securities will affect the relevant lower limit of the shareholder probability distributions differently (cf. Fig. 6.3). Thus, financial risk and leverage are not identical concepts, and from an empirical standpoint there is some question as to whether financial risk should be measured by leverage alone. In measuring financial risk an attempt should be made to keep the financial risk measure homogeneous. The greater the heterogeneity in the risk measure, the less certain one can be of the results obtained.

In the third place, it seems reasonably certain that if inflation is the expectation, the potential dollar gains—as well as real gains—of levered stocks are greater than potential losses and greater than the potential dollar gains of unlevered stocks. Case I was an attempt to give expression to this view in terms of skewed investor probability distributions. In this connection it is interesting to note the following two quotations:

Frequently, companies in industries requiring a large capital investment have a heavy senior capitalization, but this is by no means universal, and the existence of debt and preferred stock should be considered independently as an asset of great value during an inflationary period.¹

¹ Norcross S. Tilney, *Security Selection During a Period of Inflation* (New York: Arnold Bernhard & Company, 1959), p. 9.

Only for equities without leverage, however, does the rule that stocks should not rise in anticipation of inflation hold true. If senior securities are outstanding, then stocks should respond twice, or rather in two steps, to inflation; first on the promise, and second during the fulfillment, of inflation.¹

If in fact the shares of levered companies are more attractive than the shares of unlevered companies when inflation is expected, then this should be reckoned with in interpreting observed yield-debt/equity relations, for inflation and inflationary sentiment have been important in the American economy since 1945. When inflationary expectation is recognized, the result is that a number of observed yield curves with different slopes must be admitted. In 1959, for example, inflationary sentiment was very strong and the prospect of inflation dominated the investment literature. Thus, an observed yield-debt/equity relation for 1959 with a negative slope would be quite plausible and would not necessarily be due to statistical or sampling error.

Finally, because of extreme positive skewness in the probability distributions of heavily-levered companies, it is possible that the yields of such companies could be lower than the average yield of similar non-levered or moderately-levered companies. This writer does not wish to make any assumptions about investor risk preferences, yet it does not seem implausible to assume that when the potential gains of a stock far exceed the potential losses, such stocks can be very attractive—even to typically conservative investors—and could command a very low yield. The point in skewness where yields will begin to decline is a moot point, but it does not seem implausible to hold that there is such a point. This belief is not new, and both J. B. Williams and Graham and Dodd state that where the potential gains far exceed the potential losses, the stock yield can be low.² Two conclusions follow from this: first, extremely positively skewed probability distributions can be used as an explanation of very low yields observed for heavily-levered firms and, second, it seems incorrect to characterize the traditional yield curve as one which is first horizontal or slightly rising and then sharply rising. The speculative attraction of debt-heavy firms is not a new idea, and the traditional yield curve should be one which declines beyond a certain point.

¹ John B. Williams, *The Theory of Investment Value* (Cambridge: Harvard University Press, 1938), p. 107.

² Cf., J. B. Williams, *The Theory of Investment Value*, p. 70. Also, Graham and Dodd, *Security Analysis* (1951), pp. 556–62.

CHAPTER 7

Summary and Conclusions

This study was undertaken to test the validity of the hypothesis that the cost of capital to the firm is unaffected by capital structure, as formulated by Professors Franco Modigliani and Merton H. Miller in an article which has created controversy among both theorists and empiricists. As developed by Professors Modigliani and Miller this independence hypothesis takes the form of two propositions, one basic and one derivative. Proposition I states that the average market rate of capitalization of the firm's future income is independent of the capital structure of the firm. Alternatively, the market value of the firm is unaffected by the composition of securities in its capital structure. Implicit in this basic proposition is some relationship between the amount of debt employed by the firm and the risk premiums demanded by investors, and M & M have held that this implicit relationship is Proposition II. In its simplest form—and the form which is most appropriate for small and moderate debt ratios—Proposition II states that the yield required by investors is an increasing linear function of financial risk, as measured by the ratio of the market value of debt to the market value of equity.

The evaluation of the M & M propositions proceeded along three different lines in the present study. First of all, the validity of the evidence presented by M & M in support of their propositions, and the validity of the methods employed by them, were examined. Up to the present study, the question of the validity of the methods employed by M & M has not received serious attention by scholars—in the published literature at least—and several empirical papers have recently appeared in which the investigators proceeded along the lines of M & M.

Secondly, the theoretical bases of the M & M propositions were critically examined from the standpoint of the assumptions underlying the propositions and from the standpoint of consistency. The third approach followed in examining the validity of the propositions was empirical. From the empirical standpoint several different tests were made using three different samples and slightly different methods.

With respect to the empirical methods employed by M & M it was found that, under very frequently encountered conditions, their methods will result in tests which are biased in favor of their propositions and biased against the traditional views. The conditions which will lead to a biased test when market-value capital structure ratios are used are (1) heterogeneous samples and (2) the absence of observations with little or no debt. The conclusion that the M & M methods will be biased under these conditions was reached after a careful consideration of the heterogeneous factors in a sample and the effect of the heterogeneity on the regression line when market-value capital structure measures are used. The effects were examined by artificially holding constant all heterogeneous factors except one. The conclusion that the M & M measures are biased is also based on three empirical tests using market values presented in this paper. The first test presented was the railroad average cost test using market-value capital structure ratios. In this test it was found that, while the correlation coefficient supported the traditional view, the coefficient and regression curves were very highly dependent on one high-cost debt-free observation. The p_k which resulted was unrealistically high in spite of the high coefficient obtained. The other two tests presented used the department store sample. Using both a homogenized sample and the complete sample it was found that the use of the market-value ratios resulted in a systematic shift among the observations.

With respect to the theory underlying the M & M propositions three conclusions may be noted. First of all, the point was made that the M & M arbitrage process does rest on assumptions as to investors' risk preferences, first, because it assumes that investors are willing to take the risks of margin buying—a point made by Professor Durand—and second because it assumes that the new yield relationships resulting from the arbitrage process will continue to be satisfactory risk compensation to original shareholders—a point made by the present writer. If in fact some investors are averse to margin buying then there is a basis for believing that equality in market values between levered and unlevered firms will not be attained because of induced reactions. In the second place, it was suggested that the M & M formulation of

expected shareholder rate of return is not consistent with the concept. It does not appear logically consistent—to this writer at least—nor does it adequately describe the way in which security analysts actually estimate the shareholder rate of return. If this view is in fact correct, then either Proposition I or Proposition II, or both, are suspect from the standpoint of pure theory. Finally, it was found that the M & M Proposition II rests on certain assumptions regarding the shape of investor probability distributions. Specifically, it assumes that investor probability distributions are not skewed because of truncation arising from the limited liability of common shares. In view of the risks which many bondholders assume today, there is some basis for questioning the validity of the assumption that shareholder probability distributions are not skewed, and the ability of Proposition II to predict the risk premiums demanded by investors.

Two approaches were employed to test empirically the validity of the independence hypothesis. First, direct tests were made of the average cost of capital relation and the total market value relation. Second, yield tests were made to determine whether yields increased from zero debt up to some moderate debt range. To avoid the biases associated with market-value ratios, book-value ratios were employed as measures. To avoid possible unsuspected biases which might arise from the use of book-value ratios, and from any other source, four things were done. First, three industries with different trends and different characteristics were selected for the tests. Secondly, two different book-value measures of financial risk were employed; the one was a pure leverage measure with preferred in the numerator of the debt/equity ratio while the other kept preferred in the denominator and thereby kept the debt more homogeneous. Third, samples were broken into relatively homogeneous subsamples. This tended to reduce the possible distortion to the regression lines from heterogeneous factors. Finally, in the rail and cement sample, the averages of two subsamples with substantially different debt usage were compared. The examination of sample mean differences avoided the questions, problems, and possible biases associated with measurement.

When yield tests were made with the railroad sample, the results were not too conclusive. The relationship which seemed to describe the data best over the entire range was the positive linear relationship. The curved relationship added practically nothing. This test, then, was not inconsistent with the M & M hypothesis. However, for the lower ranges of railroad yield the relationship appeared horizontal. When average cost tests were made with the railroad sample the results were

more conclusive. The entire sample and four relatively homogeneous subsamples showed significant correlation. The fifth subsample—the large-rail sample—was more questionable, but after making allowances for the noncomparable factors it was suggested that this sample was also significant. The market value test with the rail sample was different from the M & M test and was highly significant.

The examination of the department store and cement company yields showed no significant correlation between yield and book debt/equity up to the moderate debt range; the relationship suggested, using both measures of financial risk, was an approximately horizontal one. There seemed to be a tendency for yields to increase beyond the moderate debt range, but there were not too many observations in the high ranges and the relationship was not clear. It is possible that the approximately horizontal relationships observed for the department stores and cement companies could be the result of inflationary expectations which existed in 1956, and it is therefore not safe to attempt to generalize a horizontal relationship for other years. In 1956 interest rates on medium-grade bonds increased from about 4% in the early part of the year to about 5% at the end of the year, reflecting in part, perhaps, inflationary expectations and unattractiveness of fixed-income securities. Nevertheless, on the assumption of horizontal yield relations up to the conventional debt limit (horizontal at about 10.50% for department stores and at about 7.75% for cement companies), the use of debt by department stores and cement companies in 1956 would have been cheap and would have reduced the weighted average cost of capital. This conclusion seems reasonably safe since many tests were made with the three samples, and all suggest about the same thing. Recognizing that any one individual test could be the result of chance, the probability of all tests indicating the same thing because of chance is extremely small. Thus, on the basis of the evidence presented herein, the hypothesis of independence between average cost and capital structure appears untenable.



APPENDIX A

Samples and Data

Sample I. Class I Operating Railroad Companies

(Following is a complete list of Class I railroads which were found to have common stock market valuations. Class I railroads are defined by the ICC as railroads with an annual gross revenue of at least \$3,000,000.)

Definitions

<i>Size</i>	Total revenues in 1956 in millions of dollars.
<i>Stability</i>	Percentage decline in revenues from 1953 to 1954.
<i>L</i>	Stock listed on New York or American Stock Exchange (1).
<i>E</i>	Stock eligible for New York savings bank investment (1).
<i>C</i>	Railroad controlled (1). (See note 4 for parent and percentage ownership.)

<u>Obs.</u>	<u>Basic List</u>	<u>Size</u>	<u>Stability</u>	<u>L</u>	<u>E</u>	<u>C</u>
(1)	Akron, Canton & Youngstown RR	6.0	-19.0%			
(2)	Alabama Great Southern RR	18.2	-12.0	1	1	1
(3)	Atchison, Topeka & Santa Fe RR	591.5	- 9.7	1	1	
(4)	Atlanta & West Point RR	4.1	-13.5			1
(5)	Atlantic Coast Line RR	166.6	- 7.3	1	1	
(6)	Baltimore & Ohio RR	465.5	-18.0	1		
(7)	Bangor & Aroostock RR	15.8	- 5.7	1		
(8)	Canadian Pacific RY	505.3	- 9.5	1		
(9)	Central of Georgia RY	44.8	- 6.8	1		1
(10)	Central RR Co. of New Jersey	62.9	-10.0	1		1
(11)	Chesapeake & Ohio RY	418.7	-11.5	1	1	
(12)	Chicago, Burlington & Quincy RR	257.0	- 9.3		1	1
(13)	Chicago & Eastern Illinois RR	37.6	-10.6	1		
(14)	Chicago Great Western RY	35.6	+ 4.0	1		
(15)	Chi., Milw., St. Paul & Pacific	253.9	- 8.5	1		

<u>Obs.</u>	<u>Basic List</u>	<u>Size</u>	<u>Stability</u>	<u>L</u>	<u>E</u>	<u>C</u>
(16)	Chicago, Rock Island & Pacific	200.0	-10.0	1		
(17)	Cinn., New Orleans & Texas Pac.	43.1	-10.9			1
(18)	Colorado & Southern RY	39.0	- 3.1	1		1
(19)	Delaware Lackawana & Western RR	88.8	-12.3	1		
(20)	Denver & Rio Grande Western RR	81.4	-13.7	1		
(21)	Erie RR	175.9	-16.1	1	1	
(22)	Great Northern RY	280.5	- 6.6	1	1	
(23)	Green Bay & Western RR	4.5	- 7.5	1		
(24)	Gulf, Mobile & Ohio RR	84.1	-13.2	1		
(25)	Illinois Central RR	298.4	-10.5	1		
(26)	Kansas City Southern RY	76.9	-15.0	1		
(27)	Lake Superior & Ishpeming RR	5.4	-30.5			1
(28)	Lehigh & Hudson River RY	3.4	- 7.9			1
(29)	Lehigh Valley RR	71.6	-14.0	1		
(30)	Louisville & Nashville RR	212.4	-15.6	1	1	
(31)	Maine Central RR	27.4	- 4.5			
(32)	Minn., Northfield & Southern	4.5	- 0.3			
(33)	Minn. & St. Louis RY	21.3	- 6.8	1	1	
(34)	Minn., St. Paul & S M M RR	48.0	- 1.4	1		1
(35)	Missouri Pacific RR	304.5	-10.4			
(36)	Monon RR	22.7	- 5.0	1		
(37)	Nashville, Chattanooga & St. L.	35.6	- 9.9	1		1
(38)	New York Central RR	780.4	-14.1	1		
(39)	New York, Chicago & St. Louis	174.6	-13.5	1		
(40)	Norfolk Southern RY	10.7	-11.3	1		
(41)	Norfolk & Western RY	239.7	-10.3	1	1	
(42)	Northern Pacific RY	188.2	- 5.4	1	1	
(43)	Pennsylvania RR	1,008.3	-17.0	1	1	
(44)	Piedmont & Northern RY	5.7	-13.5		1	
(45)	Pittsburgh & Lake Erie RY	42.4	-32.5	1	1	1
(46)	Pittsburgh & West Virginia RY	9.2	-18.7	1		
(47)	Reading Company	138.3	-17.5	1	1	
(48)	St. Louis-San Francisco RY	137.3	-11.0	1		
(49)	St. Louis Southwestern RY	68.0	-18.7	1		1
(50)	Seaboard Air Line RR	162.2	- 4.5	1		
(51)	Southern Pacific Company	678.3	- 9.5	1	1	
(52)	Southern RY	275.4	- 9.5	1	1	
(53)	Spokane International RR	3.7	- 3.0			
(54)	Texas & Pacific RY	81.4	-10.0	1	1	1
(55)	Union Pacific RR	514.3	- 9.9	1	1	
(56)	Virginian RY	56.5	- 2.5	1	1	
(57)	Wabash RR	119.5	-10.1			1
(58)	Western Maryland RY	52.4	-18.2	1		
(59)	Western Pacific RR	53.6	-18.7	1	1	
(60)	Western RY of Alabama	4.2	-10.0			
(61)	Wisconsin Central RR	33.6	- 9.6			1

Excluded: All Debt RFC Loans; No Basis for Estimation

(62) Tennessee Central RY 5.3 -11.2

Excluded: Average Loss During Period Under Study

(63) Boston & Maine RR

(64) Chicago & North Western RY

(65) Chi., St. Paul, Minn. & Omaha RY

(66) Missouri-Kansas-Texas RR

(67) New York, New Haven & Hartford RR

(68) New York, Ontario & Western RY

Definitions

<i>ACC</i>	Average net income for long-term investors (1954, 1955, 1956) ÷ average total market value of all securities (1956). (See notes 1 and 2.)					
<i>D/C</i>	Average long-term debt ÷ average total permanent capital, 1956 (both at book values). (See note 2.)					
% Pref.	Average preferred stock (including class A stock) ÷ average total permanent capital, 1956 (both at book values).					
<i>Yield</i>	Average net earnings for common before funds (1954, 1955, 1956) ÷ average market value of common equity (1956). (See note 3.)					
<i>D/E</i>	Average long-term debt ÷ average total equity, 1956 (both at book values).					
<i>MS/MCS</i>	Average market value of senior securities ÷ average market value of capital structure, 1956.					

<i>Obs.</i>	<i>ACC</i>	<i>D/C</i>	<i>% Pref.</i>	<i>Yield</i>	<i>D/E</i>	<i>MS/MCS</i>
(1)	9.90%	31.6%	0.0%	16.78%	46.3%	56.9%
(2)	8.09	16.9	0.0	90.4	20.3	42.3
(3)	7.34	13.7	9.0	8.95	15.9	32.4
(4)	7.20	13.0	0.0	9.67	15.0	37.2
(5)	6.30	36.3	0.0	9.80	57.0	58.0
(6)	7.56	42.1	5.1	16.93	72.7	79.3
(7)	5.88	47.4	0.0	11.43	90.1	72.2
(8)	5.68	30.9	9.3	8.58	44.7	53.3
(9)	6.68	43.2	15.4	13.39	76.1	77.1
(10)	4.68	40.4	0.0	4.40	67.8	72.1
(11)	7.77	40.8	1.1	11.05	68.9	43.2
(12)	6.16	28.6	0.0	8.39	40.0	43.4
(13)	7.89	55.3	3.4	24.71	123.7	83.2
(14)	7.63	31.5	20.5	14.48	46.0	71.4
(15)	6.57	45.0	8.5	14.67	81.8	84.8
(16)	8.16	35.6	0.0	14.02	55.2	56.0
(17)	8.35	3.5	3.3	8.64	3.6	6.5

<i>Obs.</i>	<i>ACC</i>	<i>D/C</i>	<i>% Pref.</i>	<i>Yield</i>	<i>D/E</i>	<i>MS/MCS</i>
(18)	7.05	16.4	11.2	12.58	19.6	71.9
(19)	5.58	41.9	0.0	7.08	72.3	72.9
(20)	8.46	44.7	0.0	12.45	80.5	47.2
(21)	6.11	53.7	3.0	12.98	116.0	78.6
(22)	7.58	30.4	0.0	11.59	43.7	48.1
(23)	9.22	9.1	18.1	16.13	10.0	67.7
(24)	7.20	46.6	18.8	14.49	87.3	73.7
(25)	7.86	31.9	0.0	11.92	46.7	48.5
(26)	8.29	32.2	7.9	12.94	47.4	50.7
(27)	15.59	5.8	0.0	16.81	6.2	9.6
(28)	10.37	3.3	0.0	10.98	3.5	7.6
(29)	7.93	39.4	0.0	14.65	65.1	71.1
(30)	6.73	43.8	0.0	10.15	77.8	52.2
(31)	6.29	45.4	5.9	19.06	83.1	88.0
(32)	18.62	0.0	0.0	18.62	0.0	0.0
(33)	8.80	20.9	0.0	10.77	26.4	28.6
(34)	8.97	26.5	0.0	16.77	36.1	63.2
(35)	7.25	73.6	23.0	26.96	278.8	96.1
(36)	7.34	43.5	0.0	10.75	77.0	85.0
(37)	5.60	27.5	0.0	7.10	37.9	39.4
(38)	6.99	46.1	0.0	12.98	85.5	71.2
(39)	7.57	47.6	0.0	12.62	90.8	54.3
(40)	7.35	25.9	0.0	11.36	35.0	51.4
(41)	8.22	6.1	3.9	9.18	6.5	14.0
(42)	6.10	31.8	0.0	9.09	46.7	57.1
(43)	5.63	34.6	0.0	13.53	52.9	74.3
(44)	8.51	24.1	0.0	11.18	31.8	36.3
(45)	9.83	18.5	0.0	11.98	22.7	23.7
(46)	6.63	21.3	0.0	9.91	27.1	55.5
(47)	6.89	33.0	17.4	17.31	49.2	77.6
(48)	6.00	51.7	14.0	13.67	107.0	79.2
(49)	12.73	13.7	0.0	12.58	15.9	56.3
(50)	8.04	36.4	0.0	10.78	57.2	36.2
(51)	6.66	34.1	0.0	11.37	51.7	58.2
(52)	7.47	33.1	8.1	11.58	49.5	52.0
(53)	7.23	40.2	0.0	8.87	67.3	37.6
(54)	7.04	28.0	10.4	11.09	38.9	59.0
(55)	8.09	15.1	7.8	9.57	17.8	24.7
(56)	6.96	42.2	16.0	11.10	73.0	56.7
(57)	9.33	35.3	11.5	21.04	54.6	68.9
(58)	7.42	36.8	11.4	17.42	58.2	73.5
(59)	6.35	41.4	0.0	8.77	70.7	57.2
(60)	9.01	17.9	0.0	11.89	21.8	38.2
(61)	6.89	62.8	0.0	10.92	168.5	71.1
(62)	—	76.1	0.0	11.89	318.4	—

Note 1. In most cases debts to affiliated companies were excluded from total market values as these debts were non-interest bearing. In two cases where interest was paid on debts to affiliates, market values were estimated for these debts and were included in the total market value.

Note 2. For the calculation of the average costs and debt ratios consolidated statements were used. In the two or three cases two consolidated statements were reported: one with wholly-owned subsidiaries and the other with wholly-owned and less-than-wholly-owned subsidiaries. Only consolidated statements with wholly-owned subsidiaries were used.

Note 3. In three cases participating preferred stocks were outstanding (Alabama Great Southern, Monon, and St. Louis-Southwestern). In these cases the net earnings and yield of the common were computed on a participating basis. This practice is also followed by Standard and Poor, which reports the common earnings on a participating basis in its stock reports. In the case of these three companies preferred stock was given a value of zero in the preferred stock ratio.

Note 4. Parents of controlled roads and percentage ownership are as follows:

- (1) Alabama Great Southern RR—58.8% of outstanding shares held by Southern Railway.
- (2) Atlanta & West Point RR—50.6% of outstanding shares held by Louisville & Nashville and Atlantic Coast Line.
- (3) Central of Georgia RY—62.7% of outstanding shares held by St. Louis-San Francisco Railway.
- (4) Central RR Co. of New Jersey—54.0% of outstanding shares held by Reading Railroad.
- (5) Chicago, Burlington & Quincy RR—97.2% of outstanding shares held by Northern Pacific and Great Northern.
- (6) Cincinnati, New Orleans & Texas Pacific RY—69.6% of outstanding shares held by Southern Railway and Alabama Great Southern.
- (7) Colorado & Southern RY—86.4% of outstanding shares held by Chicago, Burlington and Quincy RR.
- (8) Lake Superior & Ishpeming RR—75.2% of outstanding shares held by Cleveland Cliffs Iron Company.
- (9) Lehigh & Hudson River RY—99.3% of outstanding shares held by Central of NJ, Reading, Pennsylvania, Delaware Lackawana, Erie, and Lehigh Valley.
- (10) Minneapolis, St. Paul & S. M. M. RR—50.6% of outstanding shares held by Canadian Pacific RY.
- (11) Nashville, Chattanooga & St. Louis RY—74.9% of outstanding shares held by Louisville & Nashville RR.
- (12) Pittsburgh & Lake Erie RR—50.3% of outstanding shares held by New York Central RR.
- (13) St. Louis-Southwestern RY—77.5% of outstanding shares held by Southern Pacific RY.

- (14) Texas & Pacific RY—60.2% of outstanding shares held by Missouri Pacific RR.
 (15) Wabash RR—99.3% of outstanding shares held by Pennsylvania RR.
 (16) Wisconsin Central RR—52.4% of outstanding shares held by Canadian Pacific and Minneapolis, St. Paul & S. M. M.

Sample 2. Domestic and Canadian Department Store Companies

(The following list is a complete list of department store companies taken from *Moody's Industrial Manual*, 1957, p. a126.)

Definitions

Size	Total net sales in 1956 in millions of dollars (figures followed by asterisk were estimated from reported gross profits in 1956).
Yield	Earnings yield on common stock (average of per share earnings in 1955 and 1956 $\div$ average of high and low of common in 1956).
D/E	Debt to equity, average of beginning and end of 1956 ratios (total long-term liabilities $\div$ preferred and common equity, all at book values).
D & P/C	Debt and preferred to common equity, average of beginning and end of 1956 ratios (total long-term liabilities and preferred stock $\div$ total common equity, all at book values).
D & P/MC	Average book value of debt and preferred $\div$ market value of common equity, 1956.

<u>Basic List: Cos. Used in Study</u>	<u>Size</u>	<u>Yield</u>	<u>D/E</u>	<u>D & P/C</u>	<u>D & P/MC</u>
(1) Allied Stores Corporation	581.9	10.09	25.7	47.4	53.4
(2) Associated Dry Goods Corp.	223.7	11.41	26.1	61.2	65.9
(3) Ayres (L. S.) & Co.	50.2	12.65	10.6	40.2	62.8
(4) Best & Company, Inc.	40.1	9.49	17.9	17.9	18.3
(5) Brager-Eisenberg, Inc.	3.9	11.89	14.3	14.3	56.4
(6) Broadway-Hale Stores, Inc.	137.4	10.81	30.1	55.2	66.8
(7) Bullocks, Inc.	138.3	10.89	14.8	30.7	28.5
(8) City of Paris	15.0	16.43	27.3	76.9	1253.1
(9) City Stores Company	272.1	11.07	55.4	59.7	73.4
(10) Consolidated Dry Goods Co.	11.1	11.86	27.5	34.0	82.2
(11) Crowley, Milner & Co.	24.4	9.46	18.0	18.0	46.6
(12) Davidson Brothers, Inc.	73.2	10.75	32.9	32.9	39.2
(13) Emporium Capwell Company	91.1	10.95	24.2	24.8	29.3
(14) Fair (The)	45.6	12.22	21.4	21.4	63.4
(15) Federated Dep't. Stores	601.5	9.16	13.3	13.3	8.5
(16) Field (Marshall) & Co.	211.0	9.95	31.0	55.0	65.5
(17) Forbes & Wallace, Inc.	12.6	16.89	34.1	77.6	237.7
(18) Freiman (A. J.), Ltd.	14.7*	20.20	49.8	75.7	222.2

<i>Basic List: Cos. Used in Study</i>	<i>Size</i>	<i>Yield</i>	<i>D/E</i>	<i>D & P/C</i>	<i>D & P/MC</i>
(19) Garfinkel (Julius) & Co.	36.1	18.01	49.8	123.1	115.8
(20) Genung's, Inc.	9.9	13.40	36.3	50.9	94.8
(21) Gilchrist Company	23.0	10.07	29.1	29.1	95.3
(22) Gimbel Brothers, Inc.	350.1	12.46	62.6	87.1	123.1
(23) Goldblatt Brothers, Inc.	110.5	9.47	20.6	20.6	53.8
(24) Halle Brothers Company	50.8	15.23	39.7	74.5	187.1
(25) Hart (L.) & Son Co., Inc.	6.6	21.65	9.4	9.4	32.1
(26) Hecht Company	108.5	11.42	30.6	43.9	66.4
(27) Higbee Company	50.5	10.09	15.4	19.9	23.0
(28) Holmes (D. H.) Co., Ltd.	27.7	8.63	41.9	41.9	53.3
(29) Horne (Joseph) Company	64.8	12.15	25.1	25.1	60.9
(30) Interstate Department Stores	67.2	11.81	35.8	35.8	46.8
(31) Ivey (J. H.) & Company	22.3	11.42	4.2	6.2	7.5
(32) Kobacker Stores, Inc.	31.2	13.81	15.2	15.2	24.4
(33) Lincoln Stores, Inc.	12.3	8.07	16.5	16.5	24.5
(34) Macy (R. H.) & Co., Inc.	398.3	9.29	38.5	90.4	119.1
(35) Mandel Brothers, Inc.	31.5	5.69	0.6	0.6	5.4
(36) May Department Stores Co.	521.4	7.50	31.7	58.2	37.2
(37) Meier & Frank Co., Inc.	50.4	10.10	9.9	9.9	18.7
(38) Mercantile Stores Co., Inc.	148.8	11.20	22.2	22.2	27.4
(39) Miller & Rhoads, Inc.	30.3	16.41	30.7	60.9	114.8
(40) Montgomery Ward & Co., Inc.	1045.8	6.20	0.0	3.3	3.7
(41) Morgan (Henry) & Co., Ltd.	43.0	12.07	12.9	61.4	64.3
(42) Nash (F. C.) & Company	7.7	18.71	38.3	38.3	64.3
(43) Outlet Company	16.1	9.41	0.0	0.0	0.0
(44) Penn Traffic Company	11.1	15.46	4.8	4.8	9.4
(45) Penney (J. C.) Company	1291.9	6.28	0.0	0.0	0.0
(46) Rich's, Inc.	78.7	9.72	22.7	38.0	38.0
(47) Rike-Kumler Company	48.8	10.20	33.3	33.3	27.8
(48) Schuster (Ed) & Co., Inc.	43.4	14.22	37.3	76.3	126.4
(49) Scruggs-Vandervoort-Barney	59.4	10.38	13.2	31.7	64.9
(50) Sears, Roebuck & Company	3555.7	6.73	9.7	9.7	4.2
(51) Sibley, Lindsay & Curr Co.	30.7	9.51	9.2	9.2	15.6
(52) Simpsons, Ltd.	166.6*	5.06	56.3	56.3	51.8
(53) Stix, Baer & Fuller Co.	60.3	11.75	21.4	32.6	51.9
(54) Strawbridge & Clothier	18.1*	8.61	14.3	44.1	73.5
(55) Thalhimer Brothers, Inc.	33.4	9.98	33.7	56.8	107.5
(56) Weill (Raphael) & Co.	20.3	9.27	23.1	23.1	61.1
(57) Western Dep't. Stores	37.7	14.01	24.4	24.4	34.6
(58) Wieboldt Stores, Inc.	56.0	10.60	0.0	32.3	92.2
(59) Wolf & Dessauer Company	2.1*	20.05	16.7	16.7	29.4
(60) Woodward & Lothrop	54.0	12.62	37.6	53.5	66.1
(61) Woodward Stores, Ltd.	110.3*	7.69	48.6	53.4	48.5
(62) Younkers Brothers, Inc.	37.1	10.00	26.5	63.9	51.1
(63) Zion's Coop. Merc. Inst.	26.7	9.10	8.8	8.8	17.4

Excluded: Dept Guaranteed by Former Parent Concern

(64) Klein (S.) Dep't. Stores	77.9	9.42	549.4	549.4	
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Excluded: Large Fur Business

(65) Hudson's Bay Company

Excluded: Loss in 1955 and 1956

(66) Daniels & Fisher Stores Co.

(67) Milliron's

(68) National Department Stores

(69) Specialty Stores Company

Excluded: No Quotation for Common

(70) Carson Pirie Scott & Company

(71) Dupuis Freres Limitee

(72) Harris (A.) & Company

(73) M. R. A. Holdings, Ltd.

(74) Ogilvy's (Jas. A.), Ltd.

(75) Pogue (H. & S.) Company

(76) Rose (Paul H.) Corporation

(77) 12th Street Store (Illinois)

(78) Wanamaker (John) (Phila.)

(79) Wolf & Marx, Inc.

Sample 3. Domestic and Canadian Cement Producers

(The following list is a complete list of cement producers taken from *Moody's Industrial Manual*, 1957, page a118.)

Definitions

Size	Total net sales in 1956 in millions of dollars.
Yield	Earnings yield on common stock (average of per share earnings in 1955 and 1956 $\div$ average of high and low of common in 1956).
D/E	Debt to equity, average of beginning and end of 1956 ratios (total long-term liabilities $\div$ preferred and common equity, all at book values).
D & C/C	Debt and preferred to common equity, average of beginning and end of 1956 ratios (total long-term liabilities and preferred stock $\div$ total common equity, all at book values).

<u>Basic List: Companies Used in Study</u>	<u>Size</u>	<u>Yield</u>	<u>D/E</u>	<u>D & P/C</u>
(1) Alpha Portland Cement Company	35.4	8.08	1.3	1.3
(2) Bessemer Limestone & Cement	9.5	9.36	3.1	9.2
(3) Calaveras Cement Company	12.1	9.09	38.8	38.8
(4) California Portland Cement Co.	n.a.	7.35	15.0	15.0
(5) Canada Cement Company	n.a.	8.34	52.4	117.6
(6) Consolidated Cement Corporation	10.2	6.27	12.1	12.1
(7) Dewey Portland Cement Company	12.7	9.88	0.0	0.0
(8) Diamond Portland Cement Company	4.6	8.98	14.6	14.6
(9) General Portland Cement Company	45.3	6.76	0.0	0.0
(10) Giant Portland Cement Company	11.6	7.68	0.0	0.0
(11) Glens Falls Portland Cement Co.	5.6	7.73	0.0	2.7
(12) Halliburton Oil Well Cementing	176.5	6.67	17.8	17.8
(13) Hercules Cement Corporation	12.0	8.75	41.8	41.8
(14) Ideal Cement Company	77.7	6.34	0.0	0.0
(15) Keystone Portland Cement Co.	9.7	8.93	0.0	0.0
(16) Lehigh Portland Cement Company	75.8	6.17	7.0	7.0
(17) Lone Star Cement Corporation	98.3	6.78	17.8	17.8

Basic List: Companies Used in Study

	<u>Size</u>	<u>Yield</u>	<u>D/E</u>	<u>D & P/C</u>
(18) Longhorn Portland Cement	n.a.	5.59	0.0	0.0
(19) Louisville Cement Company	14.4	8.98	0.0	2.5
(20) Marquette Cement Manufacturing Co.	42.5	7.14	30.7	41.2
(21) Medusa Portland Cement	29.4	8.46	24.9	24.9
(22) Missouri Portland Cement	20.4	7.90	22.4	22.4
(23) Monolith Portland Cement	n.a.	4.86	0.2	19.6
(24) Nazareth Cement Company	9.0	10.29	0.0	0.0
(25) North American Cement	17.5	8.01	51.5	51.5
(26) Northwestern Portland Cement	n.a.	11.26	0.0	2311.8
(27) Northwestern States Portland Cem.	7.9	8.78	0.1	0.1
(28) Oregon Portland Cement Company	n.a.	8.08	60.7	60.7
(29) Peerless Cement Corporation	15.1	7.52	25.0	25.0
(30) Penn-Dixie Cement	48.6	7.35	0.7	0.7
(31) Permanente Cement Company	43.6	4.76	39.7	39.7
(32) Riverside Cement Company	n.a.	12.06	0.0	35.3
(33) Superior Portland Cement	6.7	6.77	28.4	28.4
(34) Whitehall Cement Manufacturing Co.	8.3	8.36	22.8	22.8

Excluded: Cement Manufacturing Not Principal Activity

- (35) Pittsburgh Coke & Chemical
 (36) United States Steel Corporation

Excluded: No Quotation for Common

- (37) Allentown Portland Cement
 (38) Coplay Cement Manufacturing Company
 (39) Inland Cement Company, Ltd.
 (40) Monolith Portland Midwest
 (41) St. Lawrence Cement Company

Excluded: New Operations in 1956—No Data

- (42) La Farge Cement Co. of North America
 (43) Lake Ontario Portland Cement Company

APPENDIX B

Study of the Methods of Analysis of Nine Institutional Investors

To get some idea of the extent to which book-value and market-value capitalization ratios are used by institutional investors, questionnaires were distributed to officers in charge of investment research in nine Chicago-area institutions. The officers were met on a referral. The questionnaire consisted of two questions, each on a separate sheet of paper and each enclosed in a sealed envelope. The respondents were orally instructed to answer Question #1 first and then go on to Question #2, and not to return to Question #1 after answering Question #2. This procedure was followed to ensure that the responses to Question #1 were independent of the question asked in Question #2. It is believed that the instructions were carried out by all respondents. The two questions asked were:

Question #1

Please list several of the more important ratios which you compute to evaluate the financial risk of a prospective stock or bond investment, and indicate the items going into the numerator and denominator of each ratio.

(Note: By 'financial risk' is meant the risk associated with the financial condition of a company. This is in contrast to 'business risk'—i.e., the risk due to the economics of the industry—and 'total risk'.)

Question #2

Do you compute capital structure ratios using market values in either the numerator or denominator or both? If yes, please indicate the specific ratios computed, the use made of them, and the weight placed on them.

Pilot work on the questionnaire indicated that some clarification of the term financial risk was necessary in Question #1. Accordingly, the above note was included with Question #1. While the note perhaps leaves something to be desired, it had the advantage of: (1) avoiding the question of probability distributions for respondents; (2) not being too directive; and (3) allowing the respondents some scope.

A good part of the responses to Question #1 were not unexpected. Thus, eight respondents listed the current ratio, and all listed some form of coverage ratio. A number of different ratios pertaining to bond analysis appeared with less frequency, such as debt to tangible assets, working capital to long-term debt, etc. A number of comments also appeared which dealt with the setting of standards for particular ratios. More significant for the present study, however, is that all nine respondents listed book-value capital structure ratios. Two respondents listed in addition book-value capital structure ratios adjusted for rentals. Only two respondents listed as important to them market-value capital structure ratios.

Of the nine respondents, six indicated in Question #2 that they calculated some sort of market-value capital structure ratio. The responses have been reproduced at the end of these comments for the benefit of the reader. It will be noted from them that when market-value ratios are computed: (1) they are not given very great weight; and (2) they are used principally to evaluate senior security protection rather than common stock "riskiness."

The sample is not very large and represents, perhaps, only the most scrutinizing investors. Their methods probably go beyond those of the average investor. On the basis of their responses, and of personal evidence, this writer is therefore led to conclude that: (1) the relevance of market-value ratios in stock-yield analysis is questionable; and (2) book-value ratios are relevant in the measurement of financial risk.

The following institutions cooperated in this study:

Chicago Title & Trust Company
University of Chicago (university investments)
Commonwealth Edison Company (pension fund)
Continental Illinois Bank & Trust Company
The First National Bank of Chicago
Harris Trust & Savings Bank
The Northern Trust Company
Northwestern University (university investments)
Scudder, Stevens & Clark

Responses to Question #2

Number of "no" responses (out of 9): 3.

Response A

When we are checking the capitalization of a company we often show it two ways: (1) using book figures and (2) using book figures for debt and preferred and market value for the common equity.

The market value for the common approach serves as a sensitive index of how investors appraise a company. If there is a deterioration, it will first show up in a lower quotation for the common. If a downward trend persists, debt begins to look high and the equity to look thin (even though the book figures look good); it is a warning to take a good look at any bond investment in that company to see if it should be sold.

This approach is essentially helpful when it is felt that debt tends to be on the high side using book figures. Sometimes it looks even higher when using the market value approach.

Response B

The weight placed on the ratios market values (in both numerator and denominator) is less than that given ratios using book values. The use given the market value ratios is mostly to see if the ratios are significantly changed and an estimation of what effect they might have on the ability of the company to do further financing. (That is, to see if a more favorable balance on a market ratio basis would allow debt financing beyond a balance indicated by book value relationships.)

Response C

We usually compute capital structure ratios taking debt and preferred stock at par and common stock at market (in place of common and surplus). This is used in conjunction with a straight book value approach and is given far less weight than the book value figures.

Response D

Market value of particular issues (bond or stock)
Total market value of capital issues

(No comment given.)

Response E

The percentage of debt, preferred and common to total capitalization using debt and preferred at par value and common at market value.

Generally, we do not favor investments with a debt ratio exceeding 25% of capitalization on this basis in industrial securities.

No more than a general guide to decision making—greater emphasis put on earning power and coverage factors. One of many guides, the importance of which depends on the situation.

Response F (Given orally to interviewer.)

Capitalization ratios are computed using market value for bonds, preferred stock, and common. These ratios are computed to indicate the cushion for bondholders. Market values for common are used as there is a rough correlation of market values with future earning power, which is the principal security for bonds. The book figures are not ignored, as the market value ratios can be misleading because of cyclical fluctuations in the common stock.

APPENDIX C

Analysis of Variance Table

TO DETERMINE SIGNIFICANCE OF REDUCTION IN SQUARED DEVIATIONS
FROM AVERAGE COST OF CAPITAL CURVILINEAR REGRESSION (FIG. 5.6)

Nature of Variation	Degrees of Freedom	Sum of Squares	Mean Square s^2
Parabolic Regression	2	129.04	64.52
Deviations from Parabolic Regression	58	162.27	2.80
Totals	60	291.31	

$F(2, 58) = \frac{64.52}{2.80} = 23.04$	$F_{.05} = 3.16; F_{.01} = 4.99$
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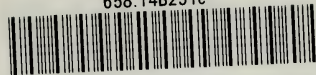


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